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Castings Hold the Ships as the Waves Roll High

EVIDENTLY chains originated a long, long time ago, since they are mentioned in the Bible as well as by many writers of that ancient period. Remains of old chains have been found in Rome, which indicate that the people of the empire used chains at an early date. Perhaps the industrial leaders of ancient Greece and Rome failed to see the possibilities of chains in industry,

Castings Are Brought Into Action When the Anchor Is Dropped

since the greatest application was for ornaments, such as emblems of investiture and badges of office, and as fetters for captives. Cordage was employed for all other purposes to which chains now are applied. An entirely different picture is revealed today, for modern industry would find it exceedingly difficult to function without chains of various types. They are used extensively in hauling and hoisting operations, in transmitting power and in connecting, confining and restraining objects. While certain types of chains used in the transmission of power long have been made up of cast malleable parts, the practice of using large steel chains for the ship's cable was developed during the war. Cast chain in this work has proved so successful that it now is being applied to other classes of work.

Find Where Castings May Be Sold

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Produce Large Tonnage

By Edwin Bremer

Repeated Use of Sand at Short Intervals Lowers the Equipment and Floor Space Required—Separate Crews for Various Operations Increase the Quantity of Nonferrous Castings Produced

NONFERROUS foundries usually produce a greater tonnage of castings from a given amount of floor space than ferrous foundries because certain precautions must be observed in handling the iron or steel castings which are unnecessary in caring for nonferrous products. The operations of making the mold and casting nonferrous metals are similar to those employed in making ferrous castings. The great difference occurs in handling the castings immediately after the castings have solidified. Due to the nature of iron carbon alloys, of which gray cast iron and steel are important members, care must be taken to prevent the formation of combined carbon which makes the castings hard. In some few gray iron foundries the castings are shaken out as soon as the metal has solidified and given a heat treatment whereby the control of the speed of cooling allows most of the carbon to assume the graphitic state. The process is the exception rather than the rule in gray iron foundries. Most of them allow the castings to remain in the sand until cool enough to handle. This method, known as self-annealing, also prevents the formation of combined carbon.

Nonferrous metals and alloys generally are not subject to this property of hardening if exposed to the atmosphere when red hot. Consequently, the castings may be removed from the sand as soon as the metal is solid and any possible hot tenderness adjusted. This feature lowers the amount of sand, floor space and equipment required to turn out a requisite number of castings because the sand and equipment are used over and over again at frequent intervals throughout the day.

An excellent example of this speed and dispatch in making nonferrous castings is noted in the shop of the National Bronze & Aluminum Foundry Co., Cleveland. The building is 120 x 235 feet and constructed of steel, brick and steel sash. The steel sash on all four sides of the building provides plenty of light and a large shaft opening in the roof directly over the furnaces provides ample ventilation so that at all times the foundry is free from smoke and fumes of the melting and casting operations. These two features, good lighting and ample ventilation, provide the employes with excellent working conditions.

This foundry makes from 30,000 to 35,000 pounds of aluminum castings and about 20,000 pounds of brass and bronze castings a day. The aluminum is melted in three specially constructed oil-fired, reverberatory furnaces of a capacity of 5000 pounds,

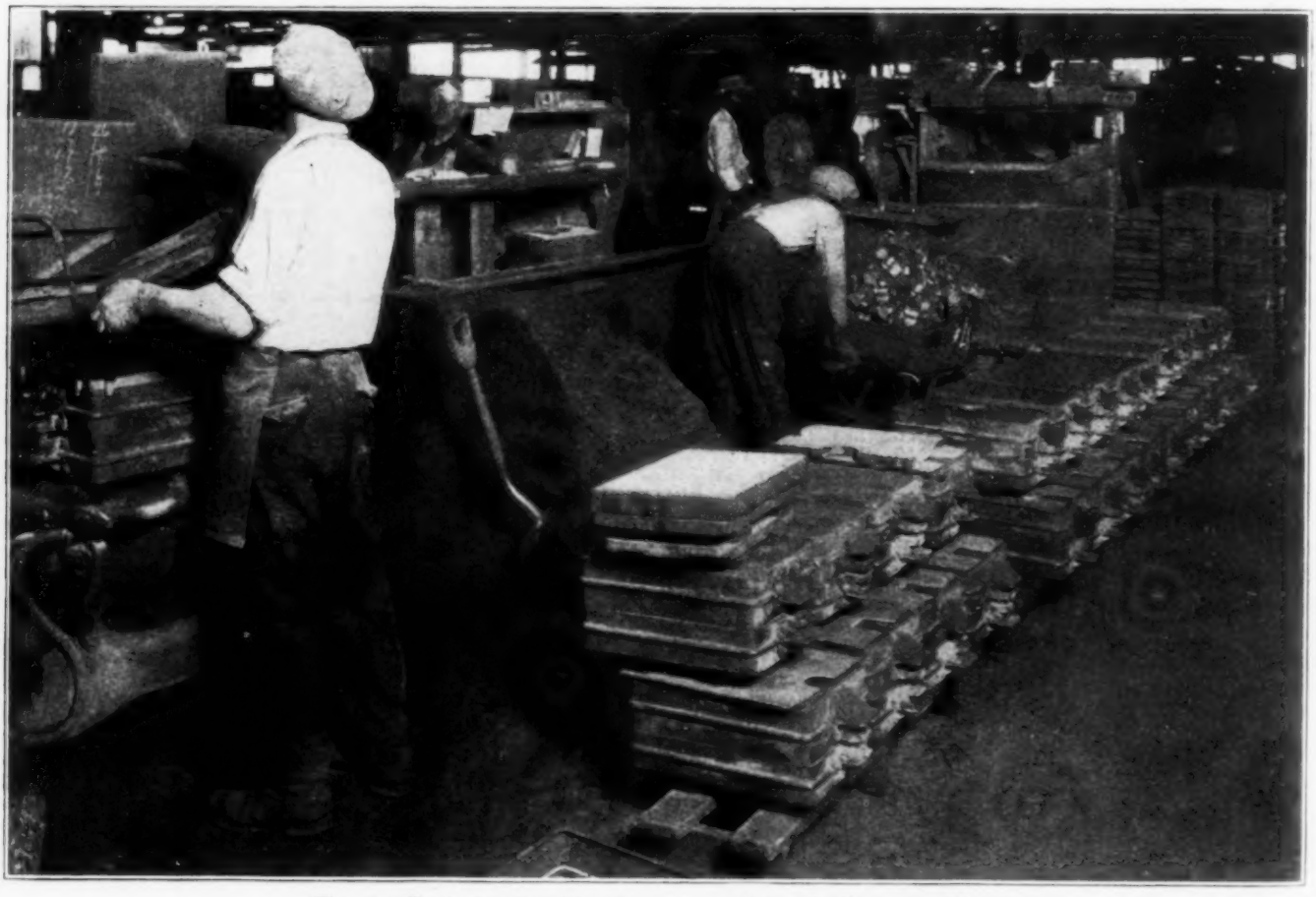


Fig. 1—Each benchmolder has a partitioned floor to himself

n Small Space

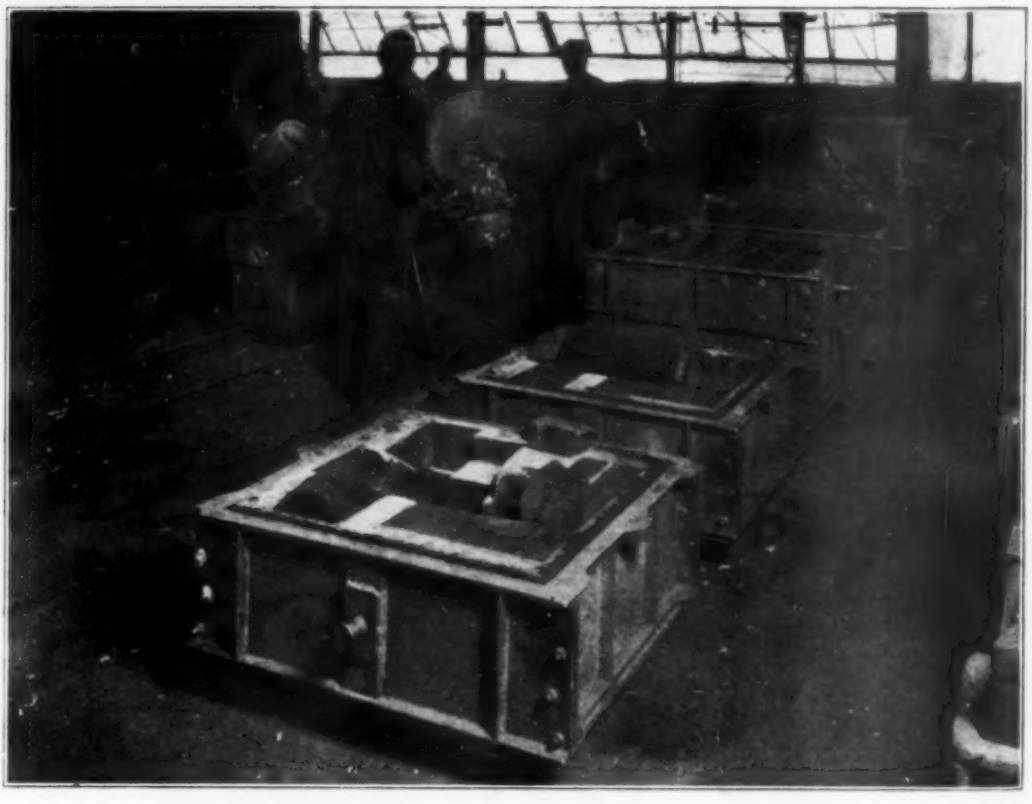


Fig. 2 — Crankcase molds in various stages before pouring. The mold in the foreground is cored in part and the next is cored in full

7000 pounds and 12,000 pounds, respectively. The raw materials used are virgin aluminum ingots, aluminum chips and turnings. These furnaces were designed and constructed in the company's own plant. Practically all of the chips and turnings used are obtained from the purchasers of the firm's castings and from sources which preclude the possibility of poor quality material.

The brass and bronze are melted in 30 oil-fired crucible furnaces that will admit a 275-pound crucible. The furnaces also made by the National company are in a pit with the top opening slightly above the floor level, of the foundry as shown in Fig. 6.

Both dry sand and green-sand cores are used in coring the molds. Green-sand cores are used wherever possible, to reduce the expense and delay of baking. Cil, liquid and dry binders are employed, the type of core determines the binder used as experience has shown that the best results are obtained by using various

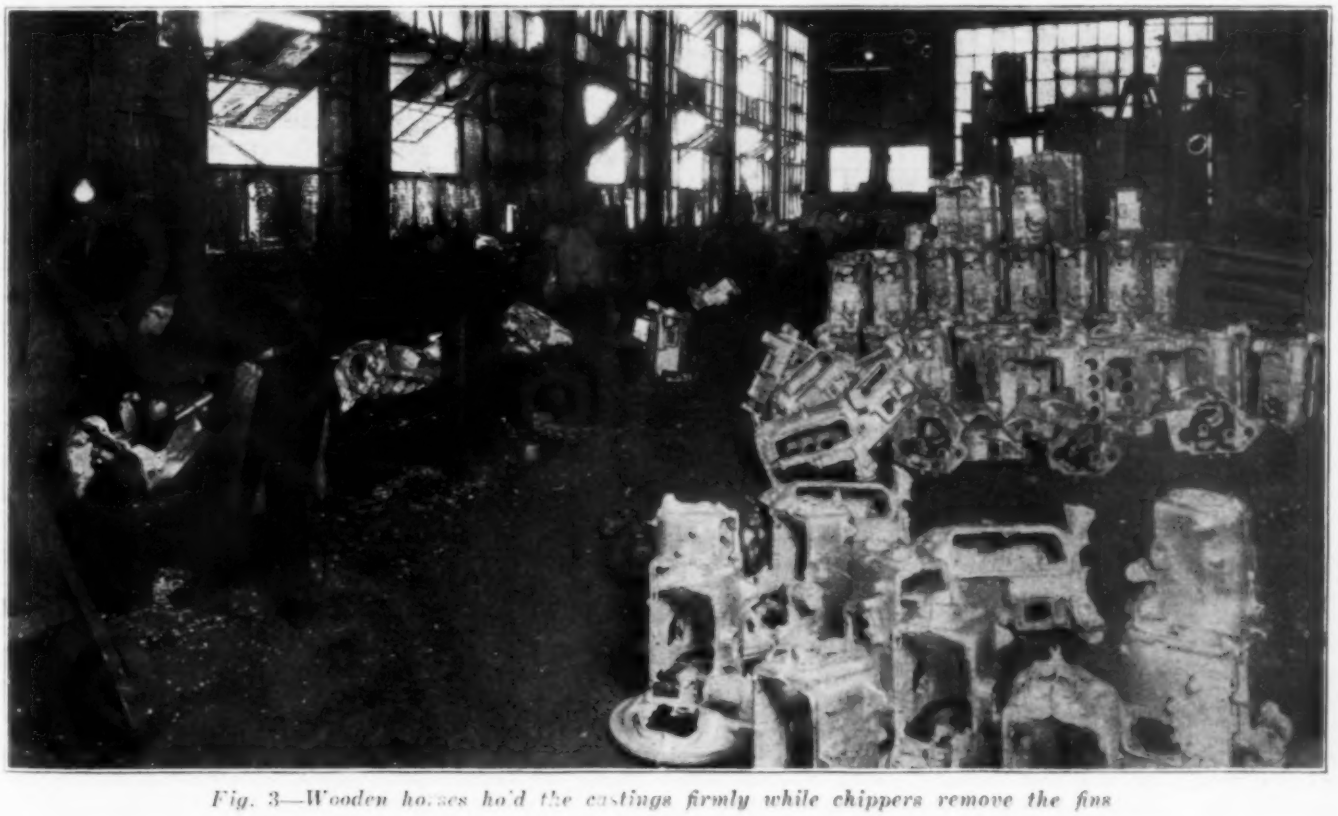


Fig. 3—Wooden horses hold the castings firmly while chippers remove the fins

binders for different classes of cores. The core ovens used at the National Bronze & Aluminum Foundry Co., are of two types. A number of brick, drawer type ovens are used for drying small cores. The large cores are dried in four large ovens manufactured by the Swartwout Co., Cleveland. Both the drawer type and the large ovens are oil fired. The baking time required for the core depends on the size. Small ones may be baked in as short a time as an hour and large ones may take 5 or 6 hours. To check up on baking temperatures, a pyrometer manufactured by the Thwing Instrument Co., Philadelphia, is used from time to time. The shelves and the lighter ones on the upper. This arrangement makes possible the storage of a large number of patterns. Adjoining the pattern storage room is the pattern repair room which is equipped to make any necessary repairs to damaged patterns or to make any changes in design that the customer may desire.

Molding machines, manufactured by the Osborn Mfg. Co., Cleveland, are employed in making the molds for the various castings made by the National Bronze & Aluminum Co. Many of the molders employed by the firm have been connected with it since the establishment of the firm in 1908. As new molders are needed, they are recruited from the ranks of the shop laborers. According to the policy adopted by John Schmeller, foundry superintendent, any laborer who exhibits intelligence and diligent application to his work, is given a chance to become a molder. The plan has worked well and so far there has been no necessity of going beyond the confines of the plant to obtain molders.

Fig. 4—Crankcase castings need many cores due to their intricate design

easily controlled burners provide uniformity in temperatures. A section of the coreroom is shown in Fig. 5.

Pattern Storage is Important

Pattern storage is an important item in any foundry. The patterns must be stored in a dry place and so arranged as to be accessible at all times. The pattern storage room of the National Bronze company is situated in the front part of the building and is 40 by 60 feet. Patterns are placed on shelf tiering that reaches nearly to the roof. Heavy patterns are placed on the lower

Brass and bronze castings generally of small or medium size are bench molded. As shown in Fig. 1, each molder works in an enclosure about 15 feet square, with a continuous wall about 4 feet high on the two sides. The ends are open in the center, except for a short division wall extending out about 3 feet each side. The molding machine is placed in one corner of the enclosure or molding floor. The prepared sand is piled along the side wall and as the molder works he shovels the sand from the pile into the flask.

Both steel and aluminum flasks are used, the former being manufactured by the Sterling Wheelbarrow Co., Milwaukee, and the aluminum flasks are made in the firm's foundry. Each molder has enough flasks to make about 28 to 30 molds and when these are completed, they are poured. The metal is poured by a special gang of men moving from floor to floor, filling the completed molds with molten metals. The molds are placed to one side of the center of the floor so that they may be poured without interfering with the work of the molder.

Handle Sand by Hand

After the castings have solidified sufficiently, they are shaken out by another crew and removed to the cleaning department in wheelbarrows. The shakeout gang then returns to prepare the sand for reuse. The usual procedure is to wet down the sand to the proper moisture content and then cut well with shovels. When the sand has been cut sufficiently, it is screened to remove any pieces of metal such as spills, broken gates or sprues. Screening the sand is accomplished by a simple device. A rectangular screen is mounted on a frame with two legs that are free to move back and forth. In screening, the arms or frame of the screen are rested on the wall and the legs placed on the ground. Sand is shoveled into the screen and the screening accomplished by sliding the frame back and forth over the wall. This method of screening the sand after each cast keeps it free from any pieces of metal that might cause defective castings. As the sand is screened, the screen is shifted along the wall. This distributes the sand in a long heap beside the wall.

Experience has shown that this system of having separate gangs to mold, to pour and to shake out the castings and temper the sand, is conducive to the best results in quantity and quality of castings. The molder is able to turn out the maximum quantity of molds because he is not interrupted. The sand condition practically is uniform as the sand gang become expert in retempering.

Small aluminum castings are han-

dled similarly to those of brass and bronze. However, in the case of larger castings such as crankcases, the procedure is different. The floors on which the molds for these castings are made are adjacent to the melting furnaces. Close proximity of the furnaces to the pouring floor has two advantages. Molten metal only has to be carried a short distance. This eliminates the need of a large supply ladle which is carried to the floor to feed the shank pouring ladles. Further, the metal does not need to be superheated much above the pouring temperature. In the reverberatory type of furnace used oxidation takes place rapidly at high temperature, but the molten metal may be held for long periods at a temperature of 50 degrees Cent. above the melting point without any serious damage. Thus, the easily regulated oil burning furnace and the short carry to the molds tends to the best melting condition with the minimum of superheat.

Make Crankcases

Copes for crankcases are made on a roll-over and pattern draw molding machine made by the International Molding Machine Co., Chicago. The sand is rammed with an air rammer manufactured by the Chicago Pneumatic Tool Co., New York. Drags are made on a roll-over, jar type molding machine manufactured by the Osborn Mfg. Co., Cleveland. A molder and a helper operate each machine.

In the case of the copes, the molder and helper place the flask in position on the machine using a rotary, air-motor crane. Clamps are adjusted to hold the flask during the roll-over period and the molder screens the sand that lies next the pattern. When a good facing layer covers the pattern, both molder and helper shovel sand into the flask until it is heaped. The molder rams the sand with the pneumatic rammer to the proper density. After ramming, the flask and pattern are rolled over, the clamps removed and the pattern vibrated and drawn. The molder then cuts the sprues and slicks the edges of the mold. After this is accomplished the mold is removed from the machine and stood on one side nearby. The same procedure is followed by the molder and helper in making drags, except that since the molding machine is of the jar type, no ramming is necessary.

Two crane men place the molds in position for pouring. A drag is picked up by a rotary air type crane and transported a short distance from the molding machines and placed on a bottom board. Cores then are placed in position by a core man and the crane men cover the drag with the cope. When the cope is in position clamps are adjusted and the mold is ready to be poured.

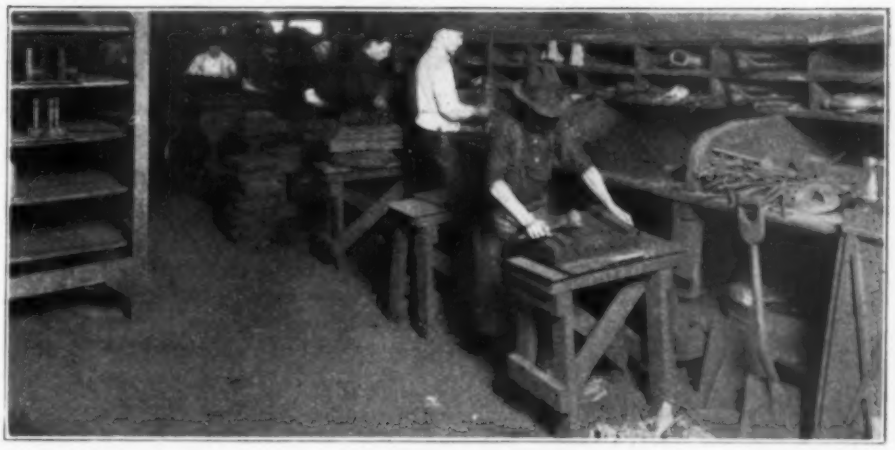


Fig. 5—Coremakers place the finished cores on racks close at hand

Separate crews pour the molten metal into the completed mold. Graphite crucibles are used as ladles to bring the metal from the furnaces which are close by. Two gates at opposite corners of the mold are used in pouring. Four headers are placed, two on a side between the gates to allow ample metal to care for shrinkage and contraction. Fig. 2 shows a floor devoted to making crankcases. In the foreground a mold in which some of the cores have been placed may be seen. Behind this mold is one that is cored fully, followed by two molds, closed and ready to receive molten metal. On the left a mold is being filled with molten metal from the graphite crucible ladles.

The main or body core of the crankcase generally is of green sand and the smaller cores are made of dry sand. Examples of some of the aluminum castings turned out in the foundry of the National Bronze & Aluminum Foundry Co. are shown in Fig. 4. On the left are several oil pans for large marine gasoline engines made by the Sterling Engine Co., Buffalo. The casting occupying the center of the group is a crankcase for the same firm. It is over 5 feet long and required 83 cores to form the necessary openings. This gives an idea of the size and intricacy of this casting. On the right of the illustration are transmission housings for large automobile busses manufactured by the White Motor Co., Cleveland.

After the mold has been poured and the metal has solidified sufficiently, the crane men remove the

(*Concluded on Page* 908)

Fig. 6—Oil-fired, pit-type furnaces are used to melt the brass and bronze

Annealing Steel Castings-II

Mild Heating Improves Test Bar Results—Coke Lowers Annealing Costs

By Larry J. Barton

Fig. 1—Water jackets and lead pots ready for annealing in pit furnace. Construction of pit furnace hungs are shown plainly in the background.

AGEING is another feature that improves test coupons. After the test piece has been machined to size it usually is put in the tensile machine at once or within a short time. It has been found that if these test pieces are allowed to stand for several weeks, the physical results obtained are superior to those obtained from tests made immediately after the machining operation. The exact reason for this phenomenon is not understood. It is maintained that the machining operation sets up certain local strains which are relieved during a rest period. It is impossible to allow a test bar to remain several weeks holding up the inspection and the shipment so some form of rapid or artificial ageing is practiced. This consists in allowing the machine bars to soak from 12 to 25 hours on a hot plate at from 150 to 200 degrees Fahr. This gives results equivalent to ageing for several weeks at room temperature. Bars processed in this manner give a tensile strength of approximately 2000 to 4000 pounds higher than the tests made immediately after machining and also show an added increase in elongation from 1 to 2 per cent. Such increase often is enough to carry a test past the dead line between rejection and acceptance.

This practice is frowned upon in some quarters as being unethical, but the writer cannot so regard it. Castings usually are not used immediately after testing, but often remain in the open for several months, and sometimes years, before going into service. The inspection tests merely determine if the castings are physically satisfactory for the work when placed in service, rather than when

Table II

Physical Characteristics Obtained by Heat Treatments

Treatment—Degrees Fahr.	Tensile strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Elongation per cent	Red area per cent
1650—2 hour soak. Cooled in still air-drawn 1300 again cooled still air	74,500	44,500	31.5	57.6
	74,250	44,500	32.5	58.6
Same as above but cooled in furnace both times	68,500	40,500	32.5	59.1
Same as above but soaked 2 hours. Furnace cooled	66,500	41,500	33.0	61.8
1650—2 hours air cool. Draw 1450 air cool	72,000	46,500	32.0	59.9
	72,000	46,500	30.5	59.4
Same as above but cooled in furnace both times	66,500	41,500	28.5	62.3
	65,500	40,500	33.5	64.7
1650—air cool. 1250—draw-air cool	81,900	61,000	25.0	55.5
	80,500	66,000	27.5	62.3
1650—furnace cooled. 1250—draw furnace cooled	69,250	47,500	31.0	62.8
	70,500	49,000	28.0	58.1
1950—2 hours furnace cooled	74,250	40,500	27.0	46.6
1800—8 hours furnace cooled	76,000	44,500	27.5	52.0
	74,750	44,500	30.0	56.0
1725—8 hours furnace cooled	73,000	45,000	27.0	58.6
	72,500	46,500	25.0	44.8
1675—8 hours furnace cooled		Flawed bar		
	73,500	46,500	30.0	59.9

first ordered. Results obtained from *aged* test piece afford a comparison of the state of the metal several weeks after manufacture when it goes into service, and as such probably represents a truer picture of the physical qualities than the test made immediately after machining.

The inspectors are particular about the appearance of the fracture where the test coupon is broken from the body of the casting. With some this is most important. Some even insist upon a reanneal for castings which give a perfect pull, but exhibit a poor annealed structure. On long castings such as locomotive frames the fracture at various points gives a comparison of the anneal at the ends and middle of the piece. Considerable controversy exists as to the right of an inspector to call for a reanneal when the pull test is satisfactory, but the writer believes this practice is justified. We know that test bars from a soft steel heat will give results from a raw bar nearly as high as from one well annealed in all except the impact test. However, if good tensile test is shown and at the same time the fracture shows good annealing, the inspector can be reasonably certain that the castings will prove suitable.

Poor annealing comes to light in another manner. Periodically, tests are made in which the fracture is found flawed, or bars are dropped on an oily machine shop floor, or for some other reason an examination of the fracture is unsatisfactory. The test is pulled and after breaking the stubs are examined. If the work is raw or poorly annealed, the surface of the stubs in the vicinity of the break will be covered with small wrinkles running longitudinally along the test piece, giving it the appearance of a test piece pulled from copper, brass or a similar alloy. A well annealed steel will cup nicely and break clean, leaving the outer skin of the pieces as smooth and shiny as before they were placed in the machine.

The following constitutes standard annealing practice for the general line of castings made for locomotives and cars.

CARBON AND CHROME STEEL

Pit Annealer:
1650 to 1675 degrees Fahr.
Soak at temperature 6 hours.
Slow cool.

This covers such castings as main frames, wheels, mud rings, driving boxes, and miscellaneous castings of large size.

Car Annealer:
1675 to 1700 degrees Fahr.
Soak at temperature 1 hour.
Cool in still air.

This covers bolsters, side frames, and castings of small cross section.

VANADIUM STEEL

Frames in pit:
1650 to 1700 degrees Fahr.
Use 5½ hours to bring up to heat.
Hold at heat 6 hours.

If carbons are from 0.20 to 0.22 pull off bungs and allow to air cool.

On carbons from 0.23 to 0.26 slow cool.

Car Annealer:
1650 to 1700 degrees Fahr.
Hold at temperature 1 hour for each inch of thickness.

Slow Cool

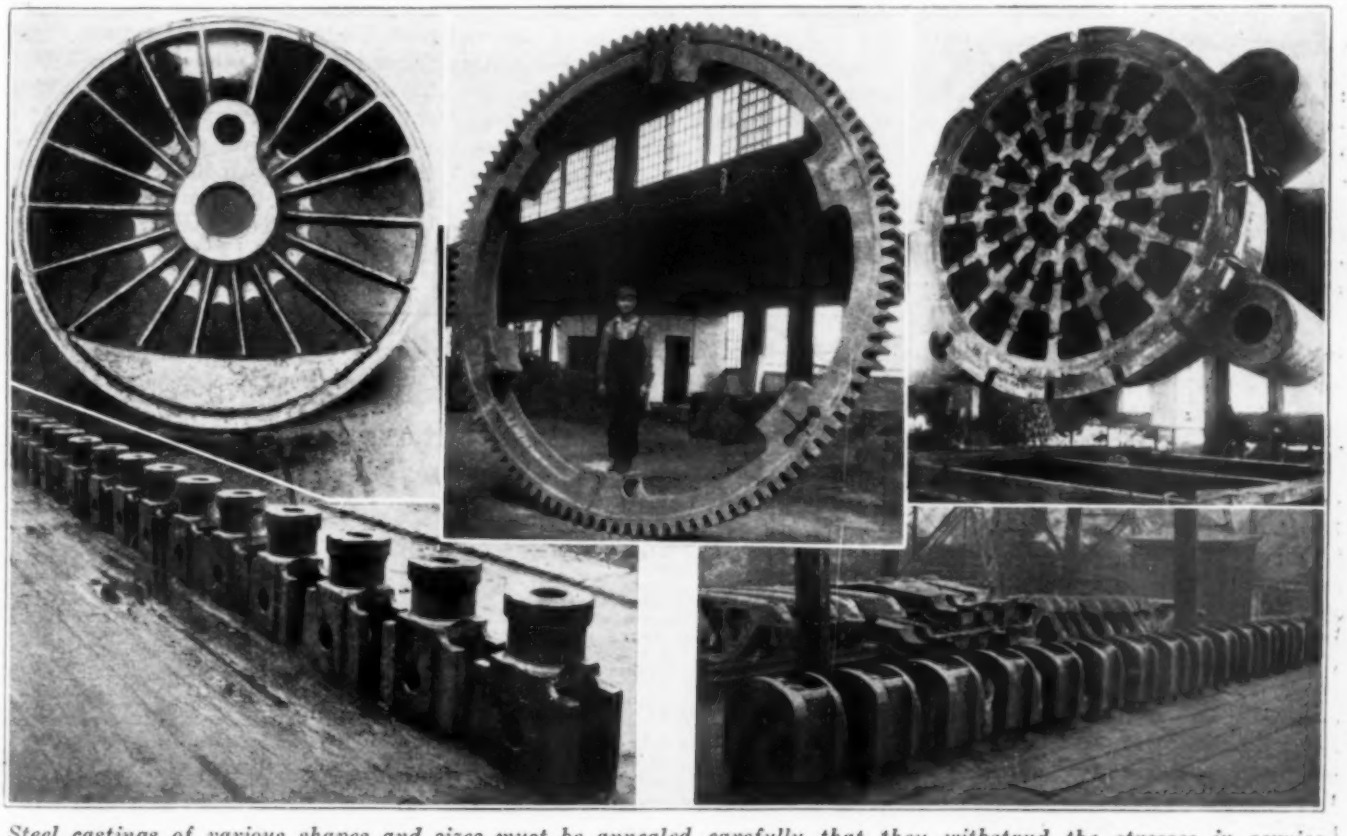
This covers crossheads, cylinderheads, driving boxes, etc.

For any special analysis or specification a separate treatment will be given. This will cover any casting requiring to be air quenched and drawn, etc.

It will be noticed that the standard practice mentioned differs in the temperatures which would be expected from the critical points determined from the various analyses. These figures have been determined carefully from practice and have been found to give the best results in heat treating these types of castings.

The experiments summarized in Table II were conducted to find the most satisfactory treatment for acid, open-hearth, vanadium steel castings. The steel analyzed: Carbon, 0.21 per cent; manganese, 0.60 per cent; vanadium, 0.19 per cent; silicon, 0.29 per cent; sulphur, 0.03 per cent, and phosphorus, 0.037 per cent. The test bars were 1 inch square in the rough and were all cast at once, being attached on the under side of a large bar. The treating was done in a small electric furnace with two pyrometers attached for temperature control.

Certain peculiarities show in these tests, the first being that test bars



Steel castings of various shapes and sizes must be annealed carefully that they withstand the stresses in service. Fig. 2, Upper left—Locomotive drive wheel. Fig. 3, Lower left—Vanadium steel locomotive cross heads. Fig. 4, Center—Gear for sugar mill roll. Fig. 5, Upper right—Head for tire vulcanizing press. Fig. 6, Lower right—Driving boxes with bolsters and side frames in the background.

Table III

Annealing Tests on High Tensile Vanadium Steel

Treatment—Degrees Fahrenheit	Tensile strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Elongation per cent	Red. area per cent
1650 Fahr.—2½ hours air cool	117,900	81,000	11.5	15.2
1660 Fahr.—2 hours air cool	112,000	80,500	12.5	17.7
1660 Fahr.—2 hours air cool Draw 1450—2 hours air cool	98,800	64,500	15.0	19.8
1700—2 hours air cool	110,560	77,250	12.9	18.2
1700—2 hours air cool 1450—2 hours air cool	97,750	65,200	15.3	19.6
Forged down to ¾ round before treating. 1660 2 hours air cool	106,250	75,800	16.0	19.1
Forged as above 1660 2 hours air cool. 1450—2 hours air cool	98,260	66,260	16.8	20.1

which have been air cooled seem to give a tougher test than do the bars which have been allowed to cool with the furnace. The second is that vanadium steel has the ability to withstand a large amount of overheating without any apparent loss of its physical properties. This is shown particularly in the test which was soaked for 2 hours at 1950 degrees, and those bars soaked 8 hours at 1800 degrees, Fahr.

The tests from which the results are compiled in Table III were made on acid, electric-furnace, vanadium steel for a high tensile specification. The steel analyzed: Carbon, 0.42 per cent; manganese, 0.93 per cent; vanadium, 0.21 per cent, and silicon, 0.52 per cent.

It is well known that considerable metal is lost in a year due to the scale formed by annealing. One prominent Chicago foundry made tests covering this point and reported a loss of 1 per cent, the work being small to medium size castings running from several ounces to several hundred pounds. To obtain a correct figure upon the general run of railroad castings, experiments were made by the writer with the following results:

	Weight before annealing	Weight after annealing	Loss lbs.
Side frame	453	449	4
	480	474	6
Bolster	750	739	11
	1 078	1.070	8
	1,072	1,066	6
	982	981	1
Truck center	4,815	4,779	36

These figures were carefully checked and the loss of 0.75 per cent was found reliable. Of this loss probably 0.15 per cent was due to sand, etc., scaling off with the oxidized metal, which probably was replaced by scale in pockets and inaccessible places where its removal was difficult. This checks closely the loss of 1 per cent on smaller size castings. Further tests gave figures which could be worked into a set rule, the loss running from 1 per cent on castings under 400 pounds, 0.75 per cent on castings from 400 to 1500 pounds, and tapering down to 0.50 per cent on castings larger than 1500 pounds. These figures were obtained on a well designed car annealer using oil as a fuel with a consumption of 12 gallons per ton of charge, the load being removed as soon as annealed, and another carload immediately placed in the furnace from the other side.

Many of the oil-fired ovens of today fire either from the top or sides. The hearth or top of car receives all its heat from radiation. The thought was advanced that if a layer of coke was spread over the top of the car before the castings were loaded, it would ignite and furnish a source of heat directly under the body of the castings, giving a more uniform anneal and resulting in a saving of time and fuel. To test this theory, a complete series of experiments was made with and without coke. Two hundred pounds of ordinary coke was used on each load, being spread evenly over the car, with a depth of 3 inches directly down the center. Recording pyrometers were used to check the temperatures and duration of annealing, while the oil was measured carefully with the latest type of meters. A hot furnace was used in every instance, the unit being arranged with two cars, one loading while the other was annealing, and as soon as one load was finished it was withdrawn and the other put into the furnace from the other side.

As shown in Table IV, the difference in oil consumption per ton of castings, annealed by the two processes was 2.15 gallons, or approximately 6.6 gallons per heat. Figuring oil at 7 cents per gallon this would show a saving of 58.2 cents on oil as against 200 pounds of coke at $4.24 per ton, or 42.4 cents amounting to a net saving of 15.8 cents per charge, or 4 cents per ton of castings. The saving in time of 1.7 minutes per ton is insignificant.

However, certain features make this process superior to the ordinary method of annealing. There is no question that the charge comes up to heat more evenly, and holds a uniform temperature better, especially on open heats such as bolsters and side frames. In the presence of this carbonaceous material it is certain that scaling will not be as heavy as it would be without the coke. When these figures are added to the slight saving previously mentioned, the practice is attractive enough for standard adoption.

Table IV

Annealing Data Using Oil With and Without Coke

HEATS USING COKE

Wt. Charge Pounds	Character	Time oil on minutes	Oil used gallons	Oil used per ton, gallons
7,560	Side frames	75	43	11.37
8,400	Bolsters	100	60	14.3
7,000	Bolsters	90	41	11.7
10,000	Strikers	165	65	13
7,000	Bolsters	85	43	12.3
8,000	Bolsters	105	50	12.5
8,000	Bolsters	105	48	12

Average time for heat 26 minutes per ton of charge. Average oil consumption 12.45 gallons per ton of charge.

HEATS WITHOUT USING COKE

Pounds		Minutes	Gallons	Gallons
7,560	Side frames	105	53	14
7,000	Side frames	90	47	13.4
7,000	Bolsters	105	56	16
6,460	Side frames	100	47	14.5
8,000	Bolsters	105	58	14.5
8,400	Bolsters	110	65	15.4

Average time for heat 27.7 minutes per ton of charge. Average oil consumption 14.6 gallons per ton of charge.

How Do You

Figure Foundry Costs?

Estimate For Bidding on Work Must Be Correctly and Accurately Prepared With All Information on the Records Considered

By Robert E. Belt

This is the second of two articles on Foundry Costs by Mr. Belt, the first appearing in the issue of Nov. 1. The articles are abstracted from a paper presented at the Detroit meeting of the American Foundrymen's association, Sept. 27 to Oct. 1.

PREPARATION of a monthly cost statement at the end of the month is the third step in a cost structure. The cost of the metal entering into the month's product may be made an integral part of the monthly cost statement or a separate statement of metal costs may be prepared. The writer favors the latter, and a set-up of metal costs is shown in Table IV.

In this way the metal charged into the cupolas during the month, the oxidation and metal loss, the weight and value of the metal poured, the weight and value of the sprue and scrap produced and the net cost of the metal per ton of good castings produced is shown clearly in percentage, pounds and value. The total weight of the charge for the month, namely, 780,000 pounds, is obtained from the daily cupola reports. The sprue and scrap produced, namely, 141,000 pounds is obtained by adjusting the home sprue and scrap melted by the difference in inventories at the beginning and end of the month. In other words, the inventory at the end of the month was 9000 pounds smaller than it was at the beginning of the month. This decrease in inventory, deducted from the home sprue and scrap melted, 150,000 pounds, gives the sprue and scrap produced. With the known production of good castings and that of sprue and scrap, the weight of metal poured is obtained readily. The difference between the weight of the metal poured and the gross charge is the oxidation and metal loss.

Monthly Cost Statement

The monthly cost statement shown in Table III is a picture of the cost of operations for the month and is obtained by setting up in statement form the balances of the cost accounts. It is a good plan to have the monthly cost statement show both the actual costs for the month and the normal costs, or what the costs would have been had the production been normal in volume.

Normal costs are obtained by adjusting the fixed plant charges and administrative and selling expense to the basis of normal operations, a production of 60 per cent of normal being assumed for illustration. Normal operations, or a normal production, may be taken as the average monthly output during the three-year period consisting of a good year, a fair year and a bad year, or as some prefer, by taking 80 per cent of the average monthly production for the best six consecutive months.

Of the items of the monthly cost statement, the direct costs, or those which can be charged directly to a particular casting or class of work, are:

Net metal cost.
Melting cost.
Molding direct labor.
Coremaking direct labor.
Returned castings and allowances.

All other items on the monthly cost statement are indirect costs, or those which cannot be charged directly to the work produced. These items have to be distributed as an overhead on the basis which will apportion the expense as nearly as possible according to the amount of such expense consumed in making the particular casting or class of work.

The procedure in distributing indirect costs, which has proved generally applicable by experience, is as follows:

1. Distribute the indirect costs of the molding department on the basis of the molding direct labor.
2. Distribute the indirect costs of

COST CARD

Customer Roe + Co
Pattern No. R2346
Pounds Per Casting 100
Pieces Per Mold 2

	Oct '26
Pounds Good Production	10,050
Production per Molder per Hour (Lbs.)	117
COSTS PER NET TON	
Metal	20 35
Melting	5 90
Molding Direct Labor	15 40
Molding Overhead	14 48
Coremaking Direct Labor	7 00
Core Overhead	8 48
Tonnage Overhead	6 45
Direct Charges (Patterns, etc.)	3 80
Total Cost Per Ton	$82 36
Cost Per Cwt.	4.12

COST ESTIMATE

Date of Estimate Sept. 20 1926
Class of Work Auto.
Name Roe + Co.
Pattern No. R2346

Pieces	Lbs. per Casting	Pcs. per Mold	Lbs. per Mold
1000	100	2	200
Molds	% Loss	Molds to Make	Castings Required
500	8	544	1100

Total Good Production	10,000	Lbs.	
	5	Tons	
Molds per Molder per hr.	6		
Good Production per hr.	120	Lbs.	
per day	960	Lbs.	
Cores per hour	22		

DAY WORK

Molding Hours	91	Rate $.40	Total	$36.90
Coremaking Hours	50	Rate $.80	Total	40.00

PIECE WORK

Molding Cost per 100 molds	Total	
Core Cost per 100 molds	Total	

			Total Cost	Cost per Ton
Metal Cost	(1 N.T.)			20 35
Melting Expense	(1 N.T.)			5 90
Molding Direct Labor				16 36
Molding Overhead	(94 %)			15 40
Coremaking Direct Labor				8 00
Core Overhead	(122 %)			9 76
Tonnage Overhead	(1 N.T.)			6 45
Direct Charges:				
Total Cost Per Ton				82 36
20 % Profit ($7.99 per Floor per Day)				16 54
Selling Price Per Ton				99 26
Per 100 lbs.				4 96

FIG. 1—THE COST CARD IS VALUABLE FOR PRICE MAKING PURPOSES. FIG. 2—EITHER PRODUCTION OR JOBBING SHOPS CAN USE THIS FORM FOR THE COST ESTIMATE

the coremaking department on the basis of the coremaking direct labor.

3. Distribute the costs of the cleaning, finishing and shipping department on the basis of the production of good finished castings, applying where practicable the cost of tumbling against the tonnage tumbled and the cost of sandblasting against the tonnage sandblasted.

4. Distribute the fixed plant charges, applying 50 per cent on the basis of molding direct labor, 10 per cent on the basis of coremaking direct labor and 40 per cent on the basis of the production of good finished castings. This percentage distribution is not entirely arbitrary but is approximately the proportions of the fixed plant charges in the average gray iron foundry of the smaller size which would be allocated to the molding department, the core department and to the cleaning, finishing and shipping department, respectively, were the charges distributed departmentally.

5. Distribute the cost of drayage on the basis of the production of good finished castings.

6. Distribute administrative and selling expense on the basis of the molding direct labor, or on the basis of units of molding floor space.

Loss on castings returned by customers is recorded on the monthly cost statement but this cost is not included in the overhead as the returns from some customers are heavy and from others light. The defective returns at the end of the month should be analyzed and the invoice price of the castings returned, less scrap value, should be applied directly to the cost of producing the particular patterns of castings returned as defective.

The metal, melting and overhead rates, using the illustrative normal cost figures of the monthly cost statement, are obtained as in Table II.

Table II

Metal, Melting and Overhead Rates

Net metal cost		$ 6,255.00
($20.85 per ton of good castings produced)		
Melting cost		1,770.00
($5.90 per ton of good castings produced)		
Molding direct labor		5,400.00
Molding indirect costs	$3,180.00	
50 per cent of fixed plant charges	504.00	
Administrative and selling expense	1,386.00	
		5,070.00
($5,070.00 ÷ $5,400.00 = 94.0% overhead on molding direct labor)		
Coremaking direct labor		2,100.00
Coremaking indirect costs	$2,445.00	
10% of fixed plant charges	100.80	
		2,545.80
($2,545.80 ÷ $2,100.00 = 121.2% overhead on coremaking direct labor)		
Cleaning, finishing and shipping costs	$1,380.00	
40% of fixed plant charges	403.20	
Drayage	150.00	
		1,933.00
($1,933.20 ÷ 300 tons of good casting produced gives a tonnage overhead of $6.45		
Direct Charges:		
Returned castings and allowances		120.00
Total cost		$25,194.00

Costs, throughout the foundry industry, divide themselves into four classes, namely, tonnage costs, class costs, customer's costs (the cost to produce the entire work of a given customer), and job costs.

Tonnage costs are averages per ton to produce the entire output of the plant for a stated period. They are found by dividing the amount of the several cost items by the output in tons. In a jobbing foundry, tonnage costs are almost worthless for price making purposes with varied jobs.

COREMAKER'S WEEKLY PRODUCTION RECORD

Amount 35 20

Coremaker J. Smith No. 34 Week ending Oct. 9, 1926

DATE	TOTAL CORE HOURS P. W.	TOTAL CORE HOURS D. W.	CUSTOMER	CORES MADE	HOURS	CUSTOMER	CORES MADE	HOURS	CUSTOMER	CORES MADE	HOURS
			PATTERN NO.	R2346		PATTERN NO.	X40		PATTERN NO.	960	
			CORE LETTER			CORE LETTER			CORE LETTER		
			CORES ORDERED	1100 - 210		CORES ORDERED	660		CORES ORDERED	8	
Oct. 4		8		100	4		140	4			
5		8		110	4 1/2		120	3 1/2			
6		8		126	4 1/2		100	3 1/2			
7		8		80	3		162	5			
8		8		116	4		138	4			
9		4								8	4
TOTAL		44		532	20		660	20		8	4
RATE					.80			.80			.80
AMOUNT					16.00			16.00			3.20

DATE	TOTAL CORE HOURS P. W.	TOTAL CORE HOURS D. W.	CUSTOMER	CORES MADE	HOURS	CUSTOMER	CORES MADE	HOURS	CUSTOMER	CORES MADE	HOURS
			PATTERN NO.			PATTERN NO.			PATTERN NO.		
			CORE LETTER			CORE LETTER			CORE LETTER		
			CORES ORDERED			CORES ORDERED			CORES ORDERED		
TOTAL											
RATE											
AMOUNT											

FIG. 3—A COMPLETE RECORD OF THE COREMAKING COSTS IS KEPT ON THIS FORM

Table III

Monthly Cost Statement

Good castings produced .....300.0.....Tons Month of .....192....

	Actual Cost amount	Actual Cost per ton	Normal Cost* amount	Normal Cost* per ton
Net metal cost	$6,255.00	$20.85	$6,255.00	$20.85
MELTING DEPARTMENT:				
Indirect labor	720.00	2.40	720.00	2.40
Fuel	780.00	2.60	780.00	2.60
Supplies and tools	150.00	0.50	150.00	0.50
Repair labor and materials	45.00	0.15	45.00	0.15
Cupola relining expense	75.00	0.25	75.00	0.25
Total	$1,770.00	$ 5.90	$1,770.00	$ 5.90
MOLDING DEPARTMENT:				
Direct labor—Molders' payroll	$5,400.00	$18.00	$5,400.00	$18.00
Indirect labor	2,310.00	7.70	2,310.00	7.70
Supplies and tools	780.00	2.60	780.00	2.60
Repair labor and materials	90.00	0.30	90.00	0.30
Total	$8,580.00	$28.60	$8,580.00	$28.60
COREMAKING DEPARTMENT:				
Direct labor—Coremaker's payroll	$2,100.00	$ 7.00	$2,100.00	$ 7.00
Indirect labor	1,530.00	5.10	1,530.00	5.10
Fuel	300.00	1.00	300.00	1.00
Supplies and tools	570.00	1.90	570.00	1.90
Repair labor and materials	45.00	0.15	45.00	0.15
Total	$4,545.00	$15.15	$4,545.00	$15.15
CLEANING, FINISHING AND SHIPPING DEPARTMENT:				
Indirect labor	$ 960.00	$ 3.20	$ 960.00	$ 3.20
Supplies and tools	300.00	1.00	300.00	1.00
Repair labor and materials	120.00	0.40	120.00	0.40
Total	$1,380.00	$ 4.60	$1,380.00	$ 4.60
FIXED PLANT CHARGES:				
Power, heat and light	$ 300.00	$ 1.00	$ 180.00	$ 0.60
Fire insurance	90.00	0.30	54.00	0.18
Liability insurance	120.00	0.40	72.00	0.24
Taxes	150.00	0.50	90.00	0.30
Depreciation	300.00	1.00	180.00	0.60
Superintendent, general foreman and miscellaneous yard labor	540.00	1.80	324.00	1.08
Miscellaneous plant expense	180.00	0.60	108.00	0.36
Total	$1,680.00	$ 5.60	$1,008.00	$ 3.36
Drayage	$ 150.00	$ 0.50	$ 150.00	$ 0.50
Returned castings and allowances	120.00	0.40	120.00	0.40
ADMINISTRATIVE AND SELLING EXPENSE:				
Office salaries	$1,500.00	$ 5.00	$ 900.00	$ 3.00
Office expense	660.00	2.20	396.00	1.32
General expense	150.00	0.50	90.00	0.30
Total	$2,310.00	$ 7.70	$1,386.00	$ 4.62
Total cost of good castings produced	$26,790.00	$89.30	$25,194.00	$83.98
Normal production per month				500 tons
Production during month				300 tons
Percentage of normal				60

*Actual cost, adjusting fixed plant charges, and administrative and selling expense to basis of normal operations.

Class costs are tonnage costs refined. In addition to determining the average cost for the entire production of the foundry the cost of the product divided into classes is determined. If the product of the foundry is subject to classifications, the procedure of recording class costs produces dependable results. When class costs are kept, the classification should be one of weight, separating the work as to plain and cored product.

Where all of the work of a customer, consisting of a variety of similar or dissimilar patterns, has been taken at a flat price, which is often the case, it usually is best to treat the customer's entire product as the cost unit. If different parts of the work take different prices, the work taken at different prices should be the cost unit or cost division. Even though the entire work of a customer is the cost unit, the cost records should be so designed to make it possible to readily determine at any time the cost of any particular pattern of casting.

In the foundry industry, owing to the multitude of patterns produced by most concerns, a somewhat greater amount of clerical labor is required to ascertain job costs than is required to ascertain either class costs or customer's costs. The fact that the cost of no two patterns is the same is sufficient reason for ascertaining job costs and for demanding a price on each pattern based upon its production cost.

Obtaining Product Costs

The procedure in determining production costs is the same, whether they are class costs, customer's costs or job costs. In brief, it is to record, by jobs or patterns of castings, the costs of the direct labor operations, mainly, molding and coremaking, and to add the cost of the molten metal and the indirect costs or overhead.

Gathering of the molding direct labor costs by patterns is the first consideration, and the form shown in Fig. 5, is suitable for that purpose in the average foundry.

There are two methods of recording the daily production of molders. One is for the timekeeper or cost clerk to record, just before the heat is poured, the name of the molder, the pattern number on which the molder is working, the number of molds poured, the pieces per mold and the hours spent in molding. The other method is to have the molder record the above information. It is preferable to have the foreman, timekeeper or cost clerk gather the information, as then it is more accurate and the workman is relieved of performing any clerical labor which he dislikes.

SUMMARY COST RECORD

Customer Roe + Co. Pounds Per Casting 10.0

Pattern No. R2346 Pieces Per Mold 2

☑ Bench ☐ Squeezer ☐ Plate ☐ Floor ☐ Machine

WEEK ENDING	MOLDER	MOLDS POURED	PIECES GOOD	PIECES BAD	POUNDS GOOD PRODUCTION	DIRECT COSTS: MOLDING HOURS	MOLDING LABOR	CORE HOURS	COREMAKING LABOR	PATTERNS AND FLASKS
Oct. 2								8	6 40	3 80
9	Doe	250	445	35	4450	40	36 00	20	16 00	
16		290	540	40	5400	46	41 40	16	12 80	
		540	985	75	9850	86	77 40	44	35 20	3 80

FIG. 4—WITH MINOR CHANGES THIS FORM IS SUITABLE FOR RECORDING CUSTOMER'S COSTS, CLASS COSTS OR JOB COSTS

The data from the molders' daily production record is carried to a molder's weekly production record, Fig. 6, for summarization. This record serves both as a payroll and as a cost record. Considerable clerical labor is saved when compared with separate payroll and cost records.

Summary Cost Record

The coremaker's weekly production record, Fig. 3, may be similar to the molder's weekly production record, and it likewise should serve both as a payroll record and a cost record.

The summary cost record, Fig. 4, is suitable, with minor changes, to record either customer's costs, class costs or job costs. The form shown is that for recording job costs. The name of the customer, pattern number, molds poured, pieces made, pounds or good castings, molding hours, and the molding direct labor are obtained from the molder's weekly production record, Fig. 6. The coremaking direct labor is obtained from the coremaker's weekly production record, Fig. 3. At the end of the month or accounting period the sheet is totaled and the results carried to the cost card which expresses the costs in units of production, per ton or per hundred pounds.

Production cost of each important pattern, of each casting, of each class of work produced, or of the entire work of a customer by months or by quarters may be summarized conveniently on a card form for the use and guidance of the sales executive. A cost card in the form shown in Fig. 1, will be invaluable for price making purposes.

Metal cost, ($20.85 per ton of castings produced) and the melting cost

Table IV

Statement of Metal Costs

Month of .....192....

Per cent of gross charge		Weight (pounds)	Average book price (N. T.)	Book value
51.3	Pig iron	400,000	$20.72	$4,144.00
28.2	Purchased cast iron scrap	220,000	18.00	1,980.00
19.2	Home sprue and scrap	150,000	18.00	1,350.00
1.3	Steel scrap	10,000	19.00	95.00
100.0	Gross charge	780,000	19.41	7,569.00
5.0	Less oxidation and metal loss	39,000		
95.0	Metal poured	741,000	20.43	7,569.00
18.1	Less sprue and scrap produced	141,000	18.00	1,314.00
76.9	Good castings produced	600,000	20.85	6,255.00
	Net tons	300.0		

MOLDERS' DAILY PRODUCTION RECORD

Sheet No..... Day Mon. Date Oct. 4, 1926

MOLDER	CUSTOMER	PATTERN NO.	MOLDS POURED	PCS. IN MOLD	PIECES MADE	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS
Doe	Roe Co.	R2346	40	2	80	72	–	8	720	7
	A.B. & Co.	72	2	1	2	2	–	–	44	1

FIG. 5—THIS RECORD MAY BE KEPT BY THE MOLDER OR BY A CLERK

MOLDER'S WEEKLY PRODUCTION RECORD

Molder Doe No. 20 Week ending Oct. 9, 1926 Amount 41.42

			Roe Co.						A.B. & Co.						Jones Machine Co.					
CUSTOMER			Roe Co.						A.B. & Co.						Jones Machine Co.					
PATTERN NO.			R2346						72						230-S					
PCS. ORDERED			1000						2						5					
PCS. IN MOLD			2						1						1					
DATE	TOTAL MOLDING HOURS P. W.	TOTAL MOLDING HOURS D. W.	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS
Oct. 4		8	40	72	–	8	720	7	2	2	–	–	44	1						
5		8	50	92	–	8	920	8												
6		6	36	65	–	7	650	6												
7		8	52	98	–	6	980	8												
8		4	20	38	–	2	380	3							5	5	–	–	550	5
9		8	52	100	–	4	1000	8												
TOTAL		46	250	465		35	4650	40						1						5
RATE								90						90						90
AMOUNT								36.00						90						4.50
CUSTOMER																				
PATTERN NO.																				
PCS. ORDERED																				
PCS. IN MOLD																				
DATE	TOTAL MOLDING HOURS P. W.	TOTAL MOLDING HOURS D. W.	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS	MOLDS POURED	PIECES GOOD	PIECES ALLOW	PIECES BAD	POUNDS GOOD	MOLDING HOURS
TOTAL																				
RATE																				
AMOUNT																				

FIG. 6—THIS INFORMATION IS GATHERED FROM THE MOLDER'S DAILY PRODUCTION RECORD

($5.90 per ton of castings produced) are obtained directly from the monthly cost statement.

Molding direct labor ($15.40 per ton), and the coremaking direct labor ($7.00 per ton) are obtained by dividing the respective costs as shown on the summary cost record by the weight of good production.

Overhead on molding direct labor ($14.48 per ton) is obtained by multiplying the molding direct labor ($15.40 per ton) by the overhead rate (94 per cent).

Overhead on coremaking direct labor ($8.48 per ton) is obtained by multiplying the coremaking direct labor ($7.00 per ton) by the overhead rate (121.2 per cent).

Tonnage overhead ($6.45 per ton) is the same on all work.

Total cost per ton is found by addition and is expressed also in dollars per hundred pounds for ready reference in hundred-weight or pound units. A line is provided on the form for the insertion, if desired, of the price per hundred pounds.

This completes the cost-finding procedure, which is not complicated and yet a cost on any important pattern of casting or on every pattern or casting may be had with a surprisingly small amount of clerical labor.

Explanation of Estimate Sheet

One of the principal uses which may be made of dependable cost information is in estimating on new work, and an estimate sheet is in a way needed for the full presentation of the subject. Before quoting on new work, an estimate should be prepared orderly and carefully and systematically preserved so that the estimate, item by item, may be checked against the cost record after a cost on the work has been established. A comparison in detail is of special benefit in disclosing items either entirely overlooked or regularly underestimated, both of which are common.

Form of estimate sheet, Fig. 2, is suitable for foundries whether their work is production or jobbing. The unit costs and overhead rates shown on the estimate sheet are those used in Table II, as in tha tway the relation of the monthly cost statement to the estimate sheet may be seen clearly.

Assuming an inquiry calls for 1000 pieces, weighing 10 pounds each, with two pieces per mold, or 20 pounds or casting per mold. Five hundred molds will be required to produce the desired quantity. If it is estimated that the foundry loss will be 8 per cent, it will be necessary to put up 544 molds to get 500 good molds or 1000 good pieces. If a molder can put up six molds per hour, it will require 91 molding hours to produce the job. At a molding rate of 90 cents per hour, the molding direct labor would amount to $81.90, or $16.38 per ton.

The casting takes one core, and to produce 544 molds requires 1088 cores. Allowing for a small breakage, 1100 cores would have to be produced. If a coremaker can produce 22 cores per hour, it will require 50 coremaking hours to produce the required number of cores. At a coremaking rate of 80 cents per hour, the coremaking direct labor would amount to $40.00, or $8.00 per ton.

Metal cost of $20.85 per ton and the melting expense of $5.90 per ton are obtained directly from the monthly cost statement.

Molding overhead, or the costs which are variable with molding direct labor is found by applying the overhead percentage (94.0) to the molding direct labor.

Coremaking overhead is found by applying the overhead percentage (122.0) to the coremaking direct labor.

Tonnage overhead, or the uniform costs which are the same per ton on all classes of castings, is $6.45 per ton.

Any special expense of producing the work, such as flasks, patterns, drilling, etc. would be included under the head of direct charges.

The total estimated cost of the job, namely, $82.74 per ton, is found by addition.

To the total estimated cost per ton is added a profit of 20 per cent which amounts to $16.54 per ton, and which is equivalent to a profit of $7.94 per floor per eight-hour day. In other words, the profit on the day's production of 960 pounds would be $7.94.

An estimate correctly and accurately prepared along the above lines, utilizing the information shown by the cost records and taking into consideration every element of cost, is the only reliable basis upon which a price on new work can be safely and intelligently made.

Begin on New Building

Chain Belt Co., Milwaukee, has started work on the third unit of its West Milwaukee plant. The building will house the steel fabricating, assembly departments, drafting room and general engineering offices. It will be 120x305 feet and constructed of steel, brick and glass. Frank B. Chase Inc., Chicago, is engineer and designer.

Describes Refractory at Institute Meeting

Development of a new refractory was announced by G. S. Fulcher of the Corning Glass Works, Corning, N. Y., at the regular fall meeting of the American Refractories institute, held at the University club, at Pittsburgh, Oct. 21. Approximately 100 members attended, including President J. M. McKinley, Curwensville, Pa.; Treasurer C. C. Edmunds, Pittsburgh; J. D. Ramsey, St. Marys, Pa.; E. A. McKelvy, Philadelphia; C. E. Kapitzky, Cleveland; George H. Diack, Lock Haven, Pa.; E. M. Keinfurtner, Ashland, Ky.; and Porter S. Kier, Pittsburgh. Others present at the meeting were L. E. Hankison of the West Penn Power Co., Pittsburgh; R. F. Geller, bureau of standards, Washington; C. W. Parmelee, University of Illinois; and S. M. Phelps, fellow in the Mellon institute, Pittsburgh.

The refractory was said by Mr. Fulcher to be three times as efficient a refractory in the glass industry as the fire clay bricks formerly used, and he believed that other industries may be able to utilize it. This new brick required five years in development work in the research laboratories of the Corning company.

Steps have been taken to standardize the variation of size in refractories and this was brought out in a paper on "Variation of Refractories" prepared by H. F. Roberts and S. M. Phelps, who hold American Refractory institute fellowships in the Mellon institute. The value of laboratory tests of refractories was indicated by R. F. Geller of the bureau of standards, Washington; and Samuel J. McDowell of the bureau of standards, Columbus, O., read a paper on the causes of slagging in refractories. Prof. Gordon B. Wilkes, Massachusetts Institute of Technology, spoke of the work at his school.

S. M. Phelps read another paper on plastic refractories which are used to replace complicated shapes in the lining of furnaces where bricks have gone bad. L. E. Hankison of the West Penn Power Co., spoke on the selection of the most satisfactory refractory for modern steam boiler linings. He said that the installation of a single large boiler requires an outlay of approximately $300,000 and that the question of refractories is of major importance.

Bridgeport Brass Co., Bridgeport, Conn., has removed its New York office from the Pershing Square building to 475 Fifth avenue.

Standardize Practice in Engine Castings

By Pat Dwyer

Fig. 1—Getting ready to set the cores in a large engine-bed mold

PREPARING sand for use presents many interesting features in the foundry of the C. & G. Cooper Co., Mt. Vernon, O. Nearly all the molds are dried before they are poured and this feature involves more time and greater care in reconditioning than if a considerable proportion of the sand remained in the green state. The molds are shaken out and the castings removed at night. The flasks are piled at convenient points for the work of the following day and the castings are distributed over that end of the main bay set apart as a cleaning room. Two large jolt machines on which the molds are rammed by day are utilized by night to shake them out.

A magnet suspended from one of the cranes is passed over all the loose piles of sand on the floor to collect the gaggers, clamps and miscellaneous pieces of metal before the sand is wet down. Passage of the magnet at a uniform height above the floor level helps to distribute the sand uniformly and thus facilitates the distribution of the water and the subsequent passage of the revolving type of sand cutter made by the American Foundry Equipment Co., Mishawaka, Ind. Sand in the side bay is handled in the same manner as the sand in the main bay. One of the cranes in each bay is equipped with magnet control. Naturally the floor of this foundry in which a considerable number of heavy patterns are bedded in the floor, presents a hill and hollow surface far different from the level brick, concrete, wood block or nearly level clay or sand floor on which sand cutting machines usually operate. The cutting cylinders are designed to operate at a definite height in relation to the wheels on which the machine is supported. In the initial trials the tendency of the machine to bury its nose in soft places in the floor seriously interfered with the speed and efficiency of the working end of the machine. Finally David M. Whyte, foundry superintendent, solved the problem in an ingenious manner by hooking a crane chain to the front side of the frame of the machine and taking just

FIG. 2—THE COPE FOR THE ENGINE BED MOLD IS CLAMPED TO A PATTERN BOARD WHERE IT IS GAGGERED AND FILLED WITH SAND BEFORE IT IS LIFTED ON TO THE TABLE OF A JOLTING MACHINE

enough weight off the front wheels. The craneman moves his bridge or carriage as the case may be in conformity with the movement of the sand cutter on the floor below.

Sand is cut up into large piles here and there over the floor and various flasks are filled later by grab buckets suspended from the cranes. Shovels only find slight application in this foundry. Pneumatic rammers are used on the molds made in the floor. Nearly all the molds are made in flasks that are jolted on machines. This applies to all molds in which the total weight of flask, pattern and sand does not exceed 50 tons.

No Vent Wires

By using an open coarse grain sand the molds may be rammed quite hard without impairing the permeability of the sand. Drying the molds tends further to produce a rigid face and as a result the castings are remarkably true to pattern with straight, smooth faces where straight smooth faces are supposed to be. Also with the exception of a few complicated molds or parts of molds the vent wire never is employed.

Interesting proof of the porosity of the sand is presented in the various open-sand molds made for flask bottom plates. These plates are heavily ribbed transversely and longitudinally on one side as may be noted in several of the accompanying illustrations and are machined on the other or plain side. A rather unusual shop kink is practiced in making these plates so that the iron will lie quietly in the mold and result in a plain face on the casting that is perfectly clean and smooth when it is machined later. The mold is made one day and left to air dry until the following day when it is filled with iron. The air drying imparts a slight skin to the sand which prevents it from crumbling or washing away in front of the stream of metal. The sand is sufficiently porous to carry all the steam out of the pockets of sand between the ribs without any assistance from a vent wire. Plates up to 7 x 15 feet are made in this manner and poured from a wide basin at one end. Plates are machined on the face to conform to the machined joints on the flask flanges.

Almost without exception all patterns are mounted on plates or boards for use on molding machines. Large engine bed molds similar to that shown in Figs. 1 and 5 are made in the floor where special foundations and binders are provided. Flasks and other equipment are under construction for molding these castings in the future and it may be that the pit method will have been abandoned before this description is published. However, new features in engine design are being developed constantly, unit sizes are increasing almost every day and it is quite possible that use will be found for the pits for an indefinite period either for larger engine beds or for other castings of a large and bulky character. The pits are served by jib cranes attached to the columns supporting the traveling crane runway as may be noted in Fig.

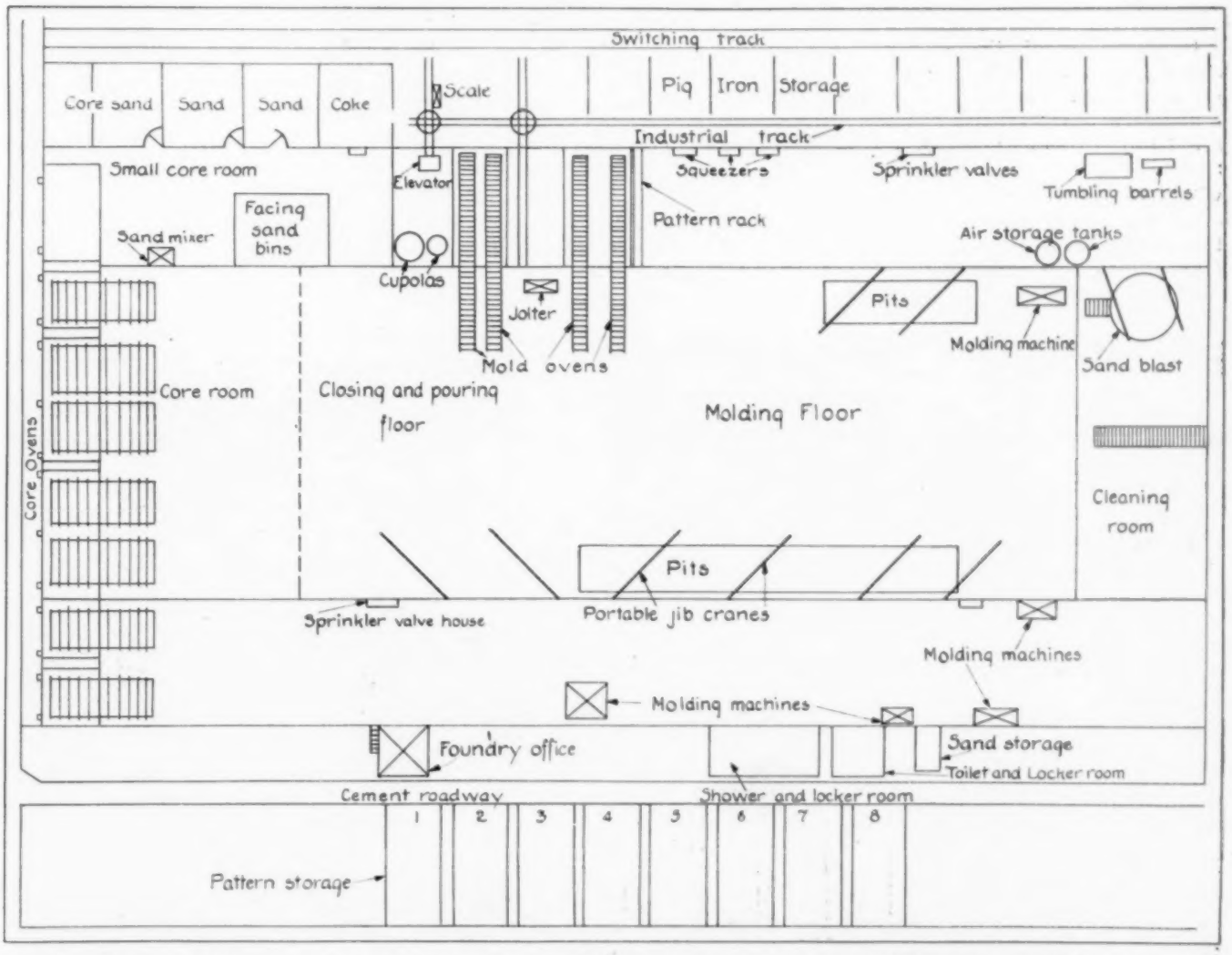


FIG. 3—GENERAL LAYOUT OF THE FOUNDRY SHOWING LOCATION OF THE VARIOUS DEPARTMENTS, CUPOLAS, CORE AND MOLD OVENS, SAND AND METAL STORAGE, MOLDING MACHINES AND PATTERN STORAGE BUILDING

FIG. 4—AN 18 X 20-INCH ENGINE BED PATTERN MOUNTED ON A BOARD AND ARRANGED ON SUITABLE SUPPORTS ON A JOLTING MACHINE. A DRY SAND CORE TAKES THE PLACE OF THE USUAL DRAWBACK ON THE CYLINDER END

7. These cranes handle the patterns, cores and binder bars and in that way relieve the powerful overhead cranes from a great deal of petty, but exceedingly necessary detail lifting.

Mold And Core Ovens

In the plan of the foundry as shown in fig. 3 two large mold drying ovens are shown in the upper bay near the cupolas. Two additional ovens are located at the left end of the lower bay where they are associated with a battery of 5 core drying ovens extending almost all the way across this end of the foundry building. The four mold drying ovens have a total combined floor area of 25,400 square feet. Combined floor area of the five core drying ovens is 19,000 square feet.

Tracks from the two large mold drying ovens extend into the main bay a sufficient distance to facilitate loading and unloading the cars with the crane. Tracks from the two smaller ovens extend into the side bay in a similar manner and for a similar purpose. The cars are substantially constructed to carry loads of flasks extending upward almost to the roofs of the ovens and are mounted on roller bearing wheels to insure ease of operation. With a snatch block anchored in the floor outside the oven, a sheave anchored to the back wall of the oven and a long chain between, the crane is utilized to pull the loaded cars into and out of the ovens.

Natural gas is cheap and plentiful in the vicinity of Mt. Vernon and therefore is used extensively around the plant of the C. & G. Cooper Co., for generating both heat and power. For example, gas engines made on the premises, are installed in the company's power house, a power house by the way that would tickle the immaculate soul of even Kipling's dour Scotch chief engineer McAndra'. Gas is employed exclusively for heating the ovens used for mold and core drying purposes.

Many changes and experiments were tried both in construction and heating features before the present arrangement was adopted permanently. Burners were tried under the floor with the heat coming up through suitable openings. They were tried at the end above the floor inside and outside the oven. A long pipe laid on the floor at each side of the oven close to the wall and provided with

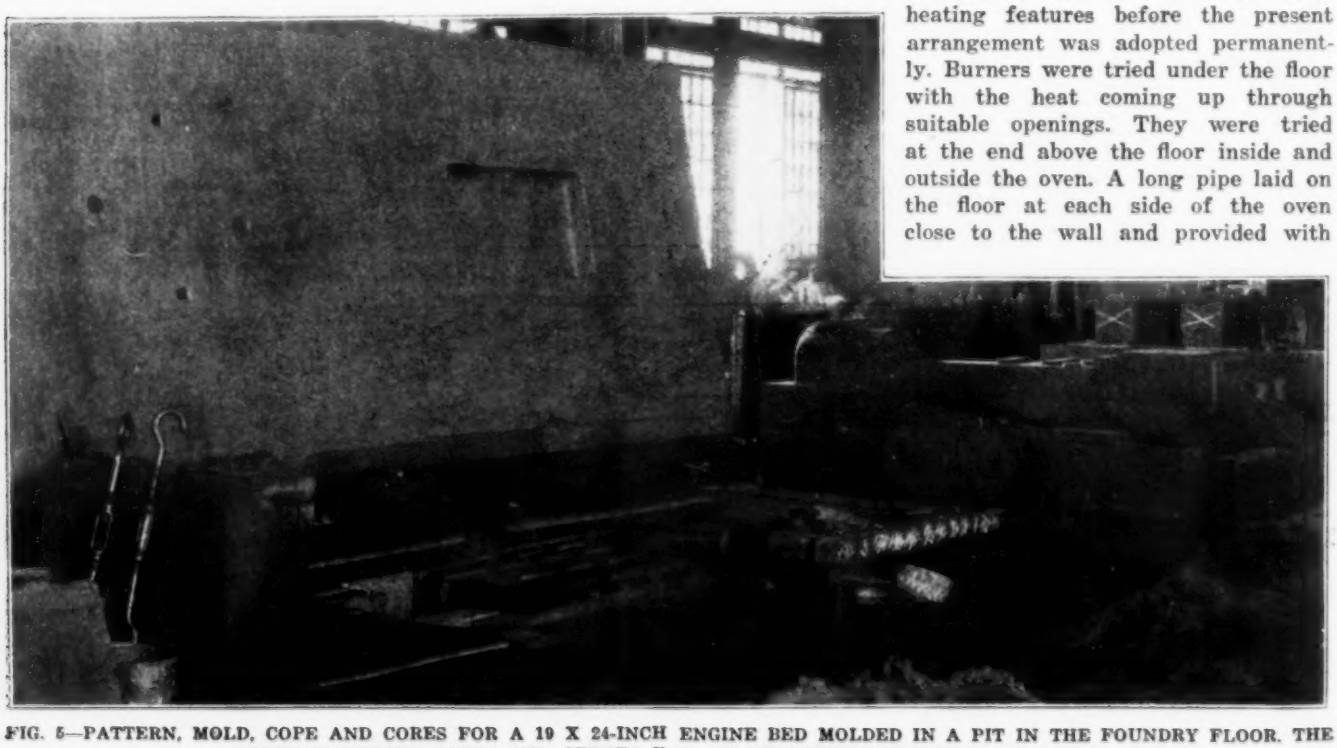


FIG. 5—PATTERN, MOLD, COPE AND CORES FOR A 19 X 24-INCH ENGINE BED MOLDED IN A PIT IN THE FOUNDRY FLOOR. THE COPE IS ROLLED DOWN AND SERVES FOR A COVER WHILE THE MOLD IS DRYING

a great number of small openings furnished the most satisfactory heat, but it was found to be wasteful. Finally a number of small gas burners were installed in place of the long pipes and these with a sheet-steel baffle plate in front of each one are in use at present and giving eminent satisfaction both from a utilitarian and an economical standpoint.

Jolt Large Molds

Steam from the damp molds escapes through a round flue in the roof of the oven. The flue is left open during the early part of the night, then it is closed by a suitable damper and the heat of the oven is raised to approximately 500 degrees Fahr. or even higher. Each oven is equipped with a pyrometer and recording equipment and the night man regulates the temperature in accordance with instructions. A 4-inch peep hole through the back wall of each oven furnishes air for combustion, but primarily it is intended for the convenience of the operator who attends the ovens. By looking through this peep hole at periodical intervals he can note the condition of the flame at the various burners and if necessary can take the necessary steps toward any readjustment.

Sequence of operation in the preparation of a large engine bed mold is shown in Figs. 4, 6 and 2. On account of the length of the pattern a number of steel rails or 6-inch I-beams are placed on the table of the molding machine to support the overhanging portion of the flask at each end. Lengths of narrow planks are placed on top of the I-beams to give the rollover board a better grip during the jolting operation. The mold is rammed on a twin cylinder machine of 25-tons lifting capacity made by the Arcade Mfg. Co., Freeport, Ill.

The pattern is centered on the board and in proper relation to the walls of the flask by suitable pins and pin holes. The cope flask is placed on a board and adjusted in a corresponding manner so that when finished, the adjoining lines of the mold in the cope and drag will coincide. Flasks are filled any place on the floor and afterward lifted upon the machine where they are rammed. The cope is handled in this manner as shown in Fig. 2 where the operator is setting the gaggers before filling the spaces between the bars with heap sand from a grab bucket. After the drag is rammed it is removed from the machine, rolled over and set down on a suitable point on the foundry floor

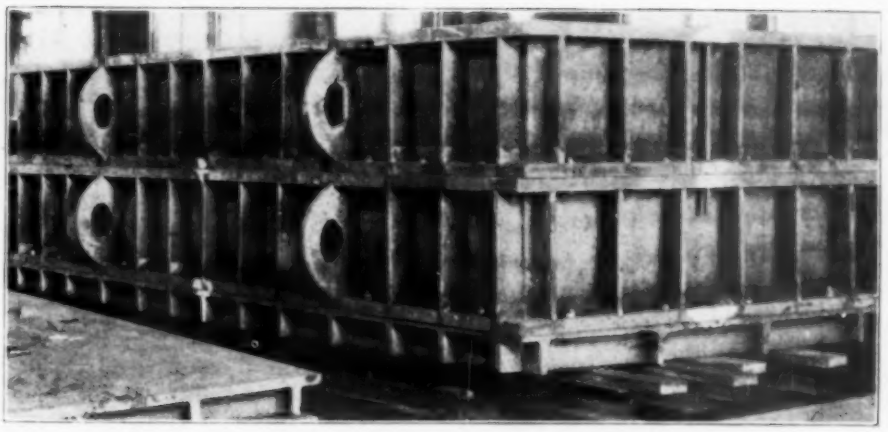


FIG. 6—TOTAL LOAD OF THIS DRAG FOR A 19 X 24-INCH ENGINE BED READY TO RAM ON THE MACHINE IS APPROXIMATELY 38 TONS

where is is finished and blacked and made ready for the oven. The cope then is placed on the molding machine and afterward treated in a similar manner.

Many Molding Machines

With few exceptions all the molds, large and small, are made according to the foregoing method. The flasks are filled with sand, lifted upon the nearest machine, jolted, lifted off, blacked and placed on the oven cars. Only the largest machines are shown in the accompanying illustration. The entire list includes one 25-ton twin cylinder jolter made by the Arcade Mfg. Co., Freeport, Ill.; one 25-ton Mumford jolter; one 10-ton shockless jolter; three ½-ton rollover jolters, two small squeezers and one squeeze-jolt machine made by the Tabor Mfg. Co., Philadelphia; one jolt rollover machine in the coreroom made by the Champion Foundry & Machine Co., Chicago.

An ingenious type of scaffold support illustrated in Fig. 2 has been developed to meet the requirements of the molder while finishing and blacking the drag. It is made from ⅝ x 2-inch flat steel bar bent somewhat like a capital *Z* and suspended from the upper flange of the flask by the upper member. The lower part of the *Z* on which the plank rests is provided with a short turned up toe to prevent the plank from slipping. Three of these carriers on each side of the flask support the scaffold on which the molder walks around the four sides of the flask while finishing the mold and preparing it for the oven. Later the same equipment is employed while he is engaged in placing the cores in the mold.

A somewhat different method was employed in making the 19 x 24-inch engine bed mold shown in Figs. 1 and 5. In this instance the pattern was bedded in a pit in the floor with the upper face flush with the floor level. Facing sand was laid up

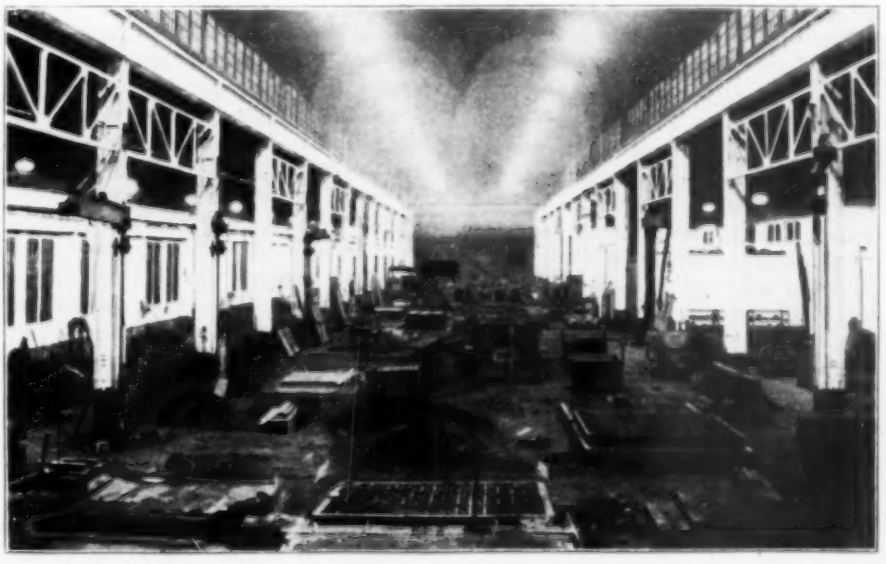


FIG. 7—EXCELLENT LIGHTING CONDITIONS SECURED THROUGH UPPER AND LOWER WINDOWS ARE GREATLY ENHANCED BY THE COATING OF WHITE PAINT WHICH COVERS THE INTERIOR OF THE WALLS, THE COLUMNS AND THE CRANE RUNWAY

against the pattern and the remainder of the pit between the pattern and the walls was rammed full of black sand reinforced by rows of suitable rods at every course. Set gates were arranged to conduct the metal into the mold near the bottom at each end.

A lifting device which is made up of two cast iron plates united by a number of arched rods was employed to carry the sand at the cylinder end of the mold. This body of sand, referred to in the foundry as a drawback, is shown removed from the mold and resting on suitable supports in Figs. 1 and 5. The relative size of the mold may be gaged from comparison with the figure of the molder shown standing on the bottom of the mold in Fig. 1.

Setting the Cores

The cope, shown standing on edge back of the mold in Fig. 5 was rammed directly on top of the pattern after the parting was made. The face of the cope was perfectly flat with the exception of the space occupied by the projection representing the bottom of the oil pan under the crank when the engine is set up in working position. For purpose of rigidity this part of the pattern was made up as a solid block rather than an exact duplicate of the metal pan.

It was doweled to the main pattern and lifted with the cope. A light frame then was placed around the opening in the main pattern and the body of sand designed to form the inside of the oil pan was built up and struck off, filleted and finished by hand. The main pattern then was removed, after which the face of the mold was blacked and then dried with a number of gas jets fed through rubber hose from a main supply pipe.

Dry sand cores supported on chaplets and separated from each other by stud chaplets serve to lighten the casting and to form longitudinal and transverse ribs to strengthen the frame against the severe strains to which it will be subjected later when placed in use in a power station of a manufacturing plant or hooked to a pump or compressor employed in driving oil or gas through 1000 miles of pipe line.

Since the foregoing was written the making of the 19 x 24-inch engine bed has been transferred entirely to the jolt machine on which the air pressure has been raised to 115 pounds per square inch. Additional storage tanks were installed and a system of pressure regulation valves laid out to insure high pressure at this machine and at the same time supply air to the pneumatic tools and for other purposes at the usual pressure of 80 pounds per square inch.

Cast-iron flasks are used almost exclusively throughout the foundry. Some are of the built-up type, that is the sides and ends have been cast separately and afterward bolted together. However, the majority of these including all those made in recent years, are typified in the large flask shown in Fig. 6. The smaller flasks are not provided with so many reinforcing ribs, but the general features are the same and they are molded after the same manner. A rectangular frame of the proper size and depth is leveled in a pit in the floor and the interior is rammed full of green sand.

Following this the frame pattern then is removed and a set of dry sand cores containing suitable cavities for the flanges and ribs, is assembled around the outide. A shoulder on each of the cores, top and bottom maintains them in the proper relation to the green sand interior. Heap sand is packed behind the cores to hold them in place and the flask casting is poured. It is a simple economical method and produces excellent flask.

The same method of molding is applied to many wheel castings, particularly wide grooved wheels designed for rope drives, wide faced pulleys, band wheels and certain types of flywheels. Small flywheels, up to 10 feet diameter, 12-inch face are made from split patterns and the molds are jolted in flasks like any routine jobs. Since these castings are symmetrical, only a half pattern is required from the pattern shop.

Piston ring patterns in various lengths are mounted on board and the molds are jolted and afterward poured without copes. The core and the mold are jolted at the same time. Long liners and sleeves are made from split patterns, molded in halves horizontally and then assembled and poured in a vertical position through a skimmer gate at the bottom. Steel additions ranging frm 25 to 40 per cent are added to the charges of metal designed to be poured into castings where great strength and density are required.

Thousands of miscellaneous patterns are kept in the fireproof pattern storage building shown in Fig. 3 and located across a concrete paved roadway from the foundry. The group of buildings is made from steel frame covered with corrugated steel sheet and supplied by the maker in knocked down condition ready for erection. This type of building lends itself readily to a program of expansion. Additional units may be added at any time. The foundry of the C. & G. Cooper Co., Mount Vernon, O., is part of an extensive manufacturing plant employing approximately 800 men and is the principal industry in the community. Relations between the management and employes are closer and more cordial than usually is the case in larger plants and in larger centers of population. Many men have been engaged steadily for varying periods of time up to 50 years. The 20-year club, which embraces in its membership all employes who have been with the company for 20 years or more, numbers over 200 members. Frequently the boys leaving school follow their fathers into the shops where they gradually develop skill of eye and hand and the class consciousness of loyalty and pride which characterizes the skilled mechanic engaged in the production of machinery on which his company bases its reputation.

Reduce Types of Shovels

After four years work, through the efforts of the producers, distributors and consumers of shovels, spades and scoops, and the division of simplified practice of the department of commerce, a reduction of 57½ per cent in the varieties of these articles has been made. Formerly 5136 shovels, scoops and spades were manufactured and through the joint action of the interested parties and the government 2178 varieties were eliminated. The number of grades also was reduced from 4 to 3.

At present six standard finishes still are retained, but the standing committee representing manufacturers, jobbers, retailers, and users hope to eliminate several of these. Information on the personnel of the committee, history of the project and shovel sizes are given in simplified practice recommendation No. 48 issued by the bureau of standards. Copies may be obtained from the superintendent of documents, government printing office, Washington; price 5 cents.

Appointed Engineer

M. I. Dorfan has been appointed engineer of the dust collecting department of the Pangborn Corp., Hagerstown, Md. Mr. Dorfan formerly was connected with the Allis-Chalmers Mfg. Co., West Allis, Wis., and other firms manufacturing dust collecting devices.

Control Sand in the Foundry-II

Shop Test Made To Determine Refractory Properties of Every New Grade of Molding Sand — Outlines Results of Tests

By L. B. Thomas

ONE sand is said to be more durable than another, to possess greater refractoriness, when it stands up longer in the heap without showing signs of going to ashes, although the clay content, permeability, and fineness are practically the same in each case.

We make a shop test on the first carload of every new grade of sand received. In addition to this shop test we conduct a severe burning out test using some simple pattern with no core work.

It is possible to make a satisfactory shop test when conditions permit the use of new sand additions to conveyors where the sand is used with jar-squeeze-draw molding machines, especially when using the continuous pouring system and one grade of iron day in and day out, making a uniform size casting with standard steel flask equipment.

When the sand handling installations are large, it is nearly impossible to obtain accurate results with one carload of molding sand. It may take six or eight loads and as many weeks to determine the several characteristics of a good molding sand in a large installation. Therefore, it is advisable to conduct similar tests on a much smaller scale.

It is also interesting to note that, although two molding sands having similar characteristics will stand up equally well under the fire test when using a sand ratio of 3.0 parts of sand to 1 part iron, by weight, yet where the inverse ratio is in effect, i. e., where the casting weighs more than the sand in the mold, one sand will burn out more rapidly than another. We will try to explain this condition later. This will be explained by a study of Table V, which gives results of sand control tests of two sands, *R R S* and *W M S*, both purchased as No. 4 sands. Table V-*A* lists the chemical analyses of the two sands, V-*B* the rational analysis and V-*C* the Smith vibratory bond test results.

The clay bond and silica per cents as determined by the method described in Appendix *A* follow:

	Per cent in sample RRS	Per cent in sample WMS
Clay substance.....	29.0	29.0
Silica (by difference)	71.0	71.0

The author has found this method reliable when using both caustic soda and tannic acid. The fineness tests of these two sands containing clay substance are reported in Table VI-*A* and the fineness tests of the sands with the clay substance removed are reported in Table VI-*B*.

Although these two sands were purchased on the open market for a No. 4 molding sand, it readily can be seen from the data of Table VI that one is finer grained than the other.

Table VII gives the permeability figures for the two sands before the burning out test was conducted. The first burning out test was made by making molds in a flask 19 inches square with a 51-inch cope and a 6-inch drag. The casting was that of a piston weighing 86 pounds. The mold and casting data are given in Table VIII.

The iron was poured from the same stock ladle into a 140 pound shank. Two molds of each sand made, one time pouring one mold containing the special sand from the shank first and then alternating. Temperatures were checked with an optical pyrometer.

Appearance of Castings

After molds were cast, they were allowed to remain until the castings could be handled with the bare hands. The sand adhering to the castings was scraped off and tempered well with water. Both castings were satisfactory from each mold, the appearance of one made with *WMS* sand was slightly better.

Following the casting of the piston in the two sands, a clay substance

Table V

Data Before Burning Out Tests

	Sand RRS per cent	Sand WMS per cent
A—Chemical Analysis		
Loss on ignition	3.44	3.06
Silica	79.45	80.16
Alumina	9.65	9.66
Iron oxide	4.11	3.79
Titania	0.48	0.22
Lime	1.00	0.63
Magnesia	0.24	0.17
Manganese	0.01	0.01
Oxide of potassium	1.25	1.12
Oxide of sodium	0.81	0.59
B—Rational Analysis		
Quartz	62.73	64.25
Feldspar	12.24	10.15
Clay substance	18.80	19.76
*C—Smith Vibrator Test**		
Clay substance	45.00	48.00
Silica	55.00	52.00

*E. W. Smith, Trans. American Foundrymen's association, vol. 31, 1924, pp. 623-630.

Table VI

Fineness Test of Sand Containing Clay Substance Purchased as No. 4 Molding Sand

A

	RRS per cent	WMS per cent
Caught on 20 mesh sieve	0.60	2.00
Caught on 40 mesh sieve	0.80	10.00
Caught on 60 mesh sieve	3.00	25.60
Caught on 100 mesh sieve	18.80	21.20
Caught on 150 mesh sieve	21.80	4.60
Through a 150 mesh sieve	55.00	36.60

Fineness Test of Sand with Clay Substance Removed

B

	RRS per cent	WMS per cent
Caught on 20 mesh sieve	1.40	2.00
Caught on 40 mesh sieve	0.80	14.00
Caught on 60 mesh sieve	4.30	24.00
Caught on 100 mesh sieve	19.80	22.85
Caught on 150 mesh sieve	24.30	5.51
Through a 150 mesh sieve	49.40	32.00

determination was made after the first burning. These determinations gave the following results:

	Per cent in sample RRS	Per cent in sample WMS
Clay substance	21.8	21.6
Silica	78.2	78.4

The permeability data of the sands after the first burning are given in Table IX.

The second burning out test was made by using an open top flask 26 inches by 13 inches with a depth of 9 inches. A chill mold was cast in this flask using first one sand then the other, the chill mold being 20 inches by 11 inches by 6 inches deep. The weight of the chill mold was 259.50 pounds, its volume 997 cubic inches compared with 2045 cubic inches of sand used.

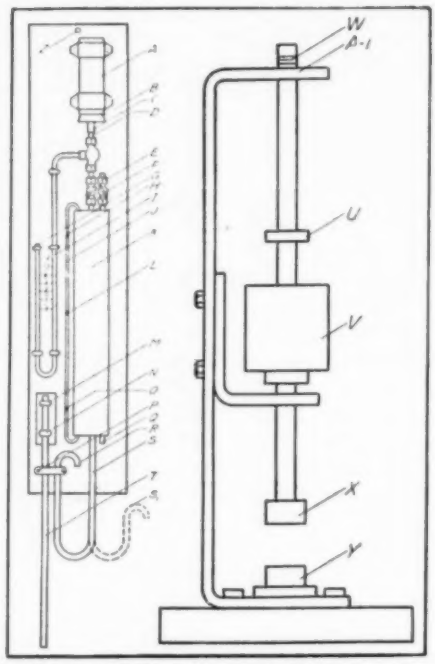
Following the casting of the chill mold, clay substance determinations were made of the two sands. The resulting data were:

	Per cent in sample RRS	Per cent in sample WMS
Clay substance	16.0	20.00
Silica	84.0	80.00

The permeability test gave the results listed in Table X.

Summary of Results of Tests

As was stated in the beginning of this brief outline, we do not feel that a sufficiently exhaustive study of the various problems has been made at this writing to arrive at any positive conclusion, nevertheless, a careful examination of the foregoing seems to bring out certain relations which may or may not hold true at all times, but which nevertheless are of interest, and may serve to stimulate further research in this particular direction.



SIMPLE DEVICE FOR DETERMINING PERMEABILITY OF SAND

The salient points are enumerated in the following general summary:

1. Moisture plays a vital part in comparing the properties of sand, and never should be omitted when reporting comparative tests.
2. Chemical analysis should be made on sands about to be adopted as standards. Often they are found by determination, to contain harmful amounts of iron, lime, magnesia, sodium and potassium.
3. Each carload shipment of sand should be tested for bond (clay substance), permeability and fineness.
4. The amount of the bonding material and the colloidal condition of this material are the important factors on the life of molding sands.
5. As a rule the permeability number of a sand increases with each heat treatment of the sand.
6. The suggested casting method of testing the life of the sand closely approaches foundry practice and is considered the best means of determining the comparative durability.
7. Proper methods should be used to insure a uniform temper of the sand.
8. The balling-up of the clay substance should be eliminated by the use of a fine water spray.
9. The best results will be obtained with a sand that has been given sufficient time to mellow, and must not be worked while steamy.
10. It is to the interest of the foundry industry as a whole to find out the durabilities of the sands in common use in the United States.

It is hoped that this brief resume of work thus far accomplished may contribute something in thought, or actual information, of value to the extensive work now being carried on by the American Foundrymen's association committee on molding sands, and to foundries engaged in similar work; and that it will point out to others the vital importance of the great problem of the foundry today.

Appendix A

Fifty grams of sand, dried thoroughly at a temperature of about 105 degrees Cent., are put into a 500 cubic centimeter Erlenmeyer flask, and about

Table VII

Permeability of Original Sands Using Vent Meter

Sample	Moisture per cent	Cm. vacuum	Time, seconds	Weight, grams	Permeability number
R R S	9.00	6.5	26	170	44.5
R R S	10.50	8.5	30	175	29.5
R R S	7.50	5.5	23.5	168	58.3
W M S	9.00	7.5	24	175	41.8
W M S	10.50	7.5	28	175	35.8
W M S	7.50	5.0	23	170	65.8

Table VIII

Burning Out Test No. 1 Mold and Casting Data

Volume of sand used per flask (cubic feet)	2.298
Specific gravity of sand, approximately	1.85-2.00
Pounds of sand per cubic inch	0.0665
Pounds per cubic foot of sand	115.00
Pounds of sand in flask (19″ x 19″ x 11″)	265.00
Weight of casting (pounds)	86.00
Specific gravity of cast iron	7.20
Weight per cubic inch of cast iron (pounds)	0.260
Weight per cubic foot of cast iron (pounds)	450.00
Volume of metal in flask (cu. in.) 330; (cu. ft.)	0.1911

Table IX

Permeability of Sands After Burning Out Test No. 1 Using Vent Meter

Sample	Moisture per cent	Cm. vacuum	Time, seconds	Weight, grams	Permeability number
R R S	9.00	7.00	27	170	39.7
R R S	10.50	10.00	32	178	23.5
R R S	7.50	7.50	24	170	41.8
W M S	9.00	4.00	23	175	81.7
W M S	10.50	4.50	24	180	69.7
W M S	7.50	3.50	22	175	97.6

Table X

Permeability After Burning Out Test No. 2 Using Vent Meter

Sample	Moisture per cent	Cm. vacuum	Time, seconds	Weight, grams	Permeability number
R R S	9.00	6.50	26	170	44.6
R R S	10.50	7.00	27	175	39.8
R R S	7.50	6.25	26	168	46.1
W M S	9.00	4.00	23	170	81.7
W M S	10.50	3.50	22	175	97.6
W M S	7.50	4.00	23	172	81.7

250 cubic centimeters water added. The flask is well stoppered and contents shaken for several minutes. The flask is opened, and a stick of sodium hydroxide about 1¼-inch in length is added, the flask is again stoppered and contents well shaken. After shaking the contents of the flask for at least 5 minutes, the stopper is removed and the sides of the flask washed down with a stream of water. After sufficient time has elapsed to allow the particles of sand (silica) to settle to the bottom of the flask (usually 5 minutes is sufficient), the colloidal material present together with any other hydrated minerals which impart to the sand a gelatinous and sticky constituent known as clay substance, is siphoned off, taking care that the grains of sand (silica) in the bottom of the flask are not disturbed.

The process of 5 minutes standing and siphoning is repeated until all the alkali (sodium hydroxide) has been removed by repeated washings. The sand, etc., remaining in the flask is again treated as outlined with one exception, i. e., tannic acid is added in place of sodium hydroxide. One spoonful of dry tannic acid is added to the flask together with 250 cubic centimeters of water and the process of 5 minutes standing and siphoning is repeated until the water remains clear at the end of the 5 minute period. By this process the clay substance is separated from the grain.

Difference in Weight

The grains of sand remaining in the flask are washed on a filter-paper, in a 9-centimeter glass funnel and allowed to drain. They are then transferred together with the filter-paper to an evaporating dish and thoroughly dried on a steam plate (bath). When dry, the sand adhering to the filter-paper is brushed off into the evaporating dish containing the bulk of the sand grains.

The difference in weight between the original sample of 50 grams and the weight of the dried grain multiplied by 2×100 equals the per cent of clay substance in the sand.

100.00 per cent—the per cent of silica grain, equals the per cent of clay substance in the molding sand.

Example:

50.00 grams (sample) molding sand taken.

40.00 grams equals weight of silica grains retained on paper.

Difference:

10.00 grams=weight of clay substance removed.

2×10.00 grams $= 20.00$ grams clay substance per 100 grams of sand.

$\frac{20.00}{100} \times 100 = 20.00$ per cent clay substance in the molding sand.

Appendix B

A good representative sample of heap or facing sand as tempered for the molders is obtained by taking small portions from different parts of the heap. Put this sample, at once, into a two quart pail with a close fitting top. Put the top on to prevent sand from drying out. Pass the sample twice through a riddle, preferably a No. 8, and return to the pail, replacing the cover.

Next place pedestal, *Y* on the table and put tube *A* down over it. Transfer about 160 grams of sand from the pail to tube *A* by means of the larger tin scoop received in vent meter box. The sand is placed in this scoop, the scoop held in the left hand in an inclined position over tube *A* and sand raked from scoop to tube *A* with a lead pencil or putty knife, taking care that it flows into tube *A* in a uniform stream and not in chunks. Do not let the scoop touch or jar tube *A* during the operation. Smooth off the upper surface of sand in tube so that it will be level.

Next lift the rammer head *V* and place tube *A* with its pedestal in the rammer. Lower rammer head *X* on sand gently at the same time adjusting position of tube so that the head slides in the tube without binding.

Comparative Tests

Place finger of left hand on top of rod above *W* just enough to prevent it from lifting. Raise weight *V* till it touches stop *U* and let it drop. Repeat this drop again and again until the weight has dropped three (3) times in all.

Now that all tests be comparative and under the same conditions the length of rammed column should be 2 inches plus or minus 4 per cent. If, by sighting along the top of the support *A*-1 you are within the three tolerance limits on gage *W* the sample is ready for test. If too short, knock out the sample and ram up a new one using more sand this time and vice versa. A small balance for weighing the sand will be of good use, so you can increase or decrease the quantity, if you are making many tests.

Note: It is advisable to support the rammer on a cast iron block weighing at least 75 pounds to get the anvil effect.

The operation of ramming should require not more than 2 minutes.

Next lift rammer to clear tube *A*, remove tube from the pedestal, insert rubber stopper *B* in end of tube, place the tube in vent meter as shown on the diagram connecting to the tube *D* by rubber connection *C*. (If the tube *D* is moistened a little with water the rubber connections slip on more easily.)

To Determine Permeability

Close valve *E* and open valve *F*. Place finger over discharge outlet S-1 and turn on water to fill tube *K* through inlet *Q*, filling slowly and stopping when reservoir is just short of full, as shown on water gage *J*.

Shut off faucet tight, close valve *F* and remove finger from discharge outlet *S*-1. Then open valve *E* and watch manometer *I*. The water level in the right leg of the U tube will rise; note this level as indicated on the scale. The tighter or less permeable the sand is, the higher the water level will go and vice versa. The reading on the scale thus obtained is a measure of the permeability of the sand by the pressure method and is good for the daily checking of sand heaps. This method is suggested by J. A. Crew, Ayers Mineral Co., Zanesville, O.

The Formula Method

This method is slower than the pressure method but should be used when comparing results with other outside concerns. Connect the rubber tube with its curved discharge to outlet *S*-1, as shown in the dotted lines on blueprint. Also fasten rod *T* in holders *M* and *N* as shown. Then proceed as in the pressure method, regulate the pressure on *U* tube by moving discharge up or down on rod *T* until the water level is exactly on one of the pressure lines of the scale. To measure the time required for the water level in gage *I* to drop from the starting point *H* to end point *L*, a stop watch graduated in minutes and tenths is advisable.

The venting power or permeability of the sand is then calculated by multiplying the time in minutes and tenths of minutes by the pressure used and dividing this product into 125.3.

By the formula: $\frac{125.3}{T\ P}$, T is time in minutes and tenths of minutes, and P is the pressure in centimeters of water as shown on the manometer *I*.

For very open sands a pressure of 1 or 2 is best to use, while for very tight sands the pressure can be carried as high as 30 or more.

The test can be made in 2 minutes.

Always check the zero on manometer *I* before starting test and before connecting up tube *A*.

To Test New Sands

To accurately determine the venting power or permeability of new sand it is best to dry out a good representative sample and divide into several portions. Temper each portion to a different degree depending whether the sand is heavily bonded or lightly bonded. After tempering, riddle once through a No. 8 (use a No. 4 if gravelly sands are used), place in a pail, put cover on tight and let stand for a few hours in a pail to equalize the temper. Then test as directed for heap sands.

This test will show how much the sand closes up with excessive temper and will show at what temper it has the most open structure after ramming. Sands differ a good deal from each other in this respect.

For lightly bonded sands it is well to temper different portions to 6, 8, 10 or 13 per cent moisture, respectively, while for heavily bonded sands, 8, 10, 12 or 14 per cent is recommended. For tempering in this way we recommend the use of an inexpensive trip balance with set of metric weights for weighing the dry portions and a glass tube graduated in metric system for accurately measuring the tempering water to any percentage desired.

Publish New Supplement

Standards adopted by the American Society for Testing Materials during 1926 have been published by the society in a 102-page pamphlet which will form the second supplement to the 1924 issue of its triennial book of standards. The pamphlet contains 23 revised or newly adopted standards. Included are standard specifications for carbon tool steel, high-speed tool steel, alloy bolting material for high-temperature service, aluminum for use in the manufacture of iron and steel, and sieves for testing purposes. Price of the pamphlet bound in paper is $1.50. It may be obtained from THE FOUNDRY, or from the American Society for Testing Materials, 1315 Spruce street, Philadephia.

S. F. Murphy Jr., well-known in industrial plants on the Pacific coast and in the Orient, has joined the service department of the Quigley Furnace Specialties Co. Inc., New York. He will make his headquarters in San Francisco and cover the entire West coast and the Orient.

Produce Large Tonnage

(*Concluded from Page* 891)

copes and carry them to the sand heap which can be seen in the background of Fig. 5. Water is sprinkled over the sand in the flask and then it is shaken out. The casting then is removed from the sand and the drag undergoes the same procedure as previously mentioned in case of the cope.

The castings are transported in wheelbarrows to the shakeout room adjoining the chipping room shown in Fig. 3. Core sand and any adhering sand is removed by vibrators. After cleaning, the casting is dragged by a long hook to the chipping room. Chippers pick up the castings and place them on wooden horses or benches which clearly are shown on the left in Fig. 3. Pneumatic chippers, principally those manufactured by the Chicago Pneumatic Tool Co., New York, are used to remove the fins along the parting joints and other places on the castings.

Use Wooden Benches

Horses or cleaning benches are made of wood and constructed to withstand severe use. The end pieces are made in the form of a cross which leaves a V-shaped opening on either side. Details of the construction may be seen in the illustration of the chipping room. The opening is of ample size to admit the larger sized crankcases and the V-shape of the opening holds the casting firmly in place as the chipper removes the fins. No holding device of any nature is required as the harder the casting is pushed down into the opening, the tighter it is gripped. It is the work of but a few seconds to turn the casting over to another position so that other parts may be chipped.

Approximately 90 per cent of the castings made by this firm are sandblasted. An automatic sandblast table machine, manufactured by the W. S. Sly Mfg. Co., Cleveland, the rear end of which may be seen in the upper right hand corner of Fig. 3, is used to perform the final cleaning and finishing operation. Tumbling mills manufactured by the same company are used where that type of finish is desired.

A large force of inspectors is maintained to examine the castings. Each casting, large or small, is scrutinized carefully for defects. The inspectors work at tables that are about waist high from the floor, when examining the smaller bronze and aluminum castings. Tables of that height obviate considerably the bending or stooping which is encountered with tables of the usual height.

Automotive castings besides being examined for casting defects also are checked for dimensions with jigs or templets. Some of these jigs or gages check several dimensions from one position of the casting, and due to the size of such gages, they are made of steel and mounted on a separate platform or bench at a convenient height from the floor.

Cleveland District Holds Sand Meeting

B. D. Fuller, Cleveland representative, Whitehead Brothers Co., New York, addressed a group of foundrymen, comprising representatives in the Cleveland district of the Ohio State Foundrymen's association at a dinner held Monday, Nov. 1. Mr. Fuller, who is general chairman of the joint sand research committee, of the American Foundrymen's association and the National Research council, outlined the practical considerations which influence the choice and treatment of different grades of molding sand.

H. B. Hanley, Whitehead Bros. Co. laboratory, Rochester, N. Y. showed a series of slides illustrating the production of molding sands in the eastern districts and commented upon the testing methods which have been developed in recent years. Mr. Hanley was invited to return to Cleveland for a meeting of the group to be held Nov. 30, when a demonstration of the different testing apparatus will be a feature.

O. J. Blank, Peck, Stow & Wilcox Co., Cleveland, is president of the group, and A. J. Tuscany, secretary-manager of the Ohio State Foundrymen's association acts as secretary.

Will Hold Anniversary

A celebration of the 25th anniversary of the bureau of standards of the department of commerce will be held on Dec. 4. The bureau will hold an open house and a banquet will be given which will be attended by distinguished guests. Reminiscences will be exchanged, achievements of the quarter century will be reviewed and the present and future work of the bureau will be discussed. The world of science is interested in the bureau because of its many discoveries and developments in perfecting measured control of processes.

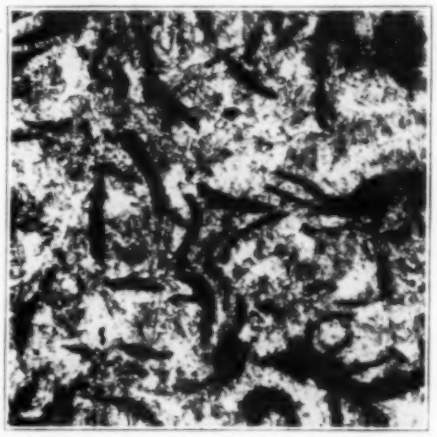
Electric Iron Has Close Grain

Alloy Metal Made in Electric Furnace Has Dense Pearlitic Structure and May Be Machined Readily at High Brinell Hardness—Applications Diversified

STATISTICS show that during the last decade the general use of gray iron castings has been decreasing steadily. Malleable iron, forged steel and steel stampings are used to a considerable extent for purposes where formerly cast iron was considered satisfactory and this product is being used more and more only where its mass is of value. Cast iron, however, is making a strong bid for its former place in industry in the form of alloy cast iron.

Close grain metal adapted to the making of thin-walled castings and having a high tensile strength and numerous other properties, as will be mentioned later, has been made possible by the addition of alloys during the refining process. The Vulcan Mold & Iron Co., Latrobe, Pa. has been experimenting for the past two years on alloy cast iron melted in an electric furnace and is now placing on the market products made of this material. The regular product of the company is ingot molds designed chiefly for high-grade soft steels and alloys steel; and, split and solid molds of the latest type for tool steels. During some research work on various grades of cast iron to determine their suitability for ingot molds, alloy cast iron was made in a crucible, melted in a resistance-type electric furnace. The unusual properties of this metal were noticed and it was decided to conduct an exhaustive experimental study of this material.

After many months of experimentation the metal yielded such highly beneficial results that plant expansion was authorized. A nearby foundry, which formerly had been engaged in the manufacture of pipe fittings, was leased and became plant No. 2. The foundry was remodeled and a large amount of new equipment was added including a traveling crane, monorail system, modern molding and core-making machinery, and other equipment designed for the production of special castings weighing from 1 pound to 1 ton. The most important addition was the installation of a ½-ton basic lined electric furnace particularly designed for melting cast iron and having a complete automatic control system. A cupola for making equipment for the No. 1 plant and other ordinary gray iron products also is available. The electric furnace has a capacity of 10 tons of alloy cast iron and the cupola about 20 tons of gray iron castings a day.



PHOTOMICROGRAPH OF ALLOY CAST IRON DIE BLOCK. THIS WAS MACHINED WITH A BRINELL OF 302

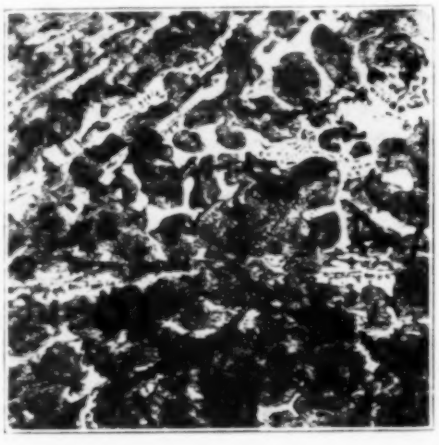
Modern Facilities Provided

The No. 2 plant now produces all of the split ingot molds made of both cupola and alloy cast iron which the company manufactures. It includes a modern brick building located on the outskirts of Latrobe, Pa. A siding from the Ligonier Valley branch of the Pennsylvania railroad parallels the building and over this spur is brought the raw materials such a sand, alloys, coke, pig iron and miscellaneous supplies used by the company. These are stored in one end of the building in a room partitioned off from the other departments of the foundry. Two cranes, one of the overhead traveling type and one of the monorail type, serve the foundry floor. Interdepartment transportation of material is facilitated by an industrial trackage system.

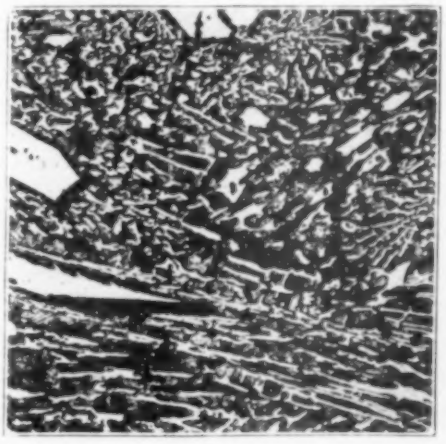
The core room is housed in a separate wing at right angles to the main plant building. It is equipped with automatically-operated core ovens and core-blowing apparatus. Ample light is provided through a series of windows built in each side wall. Following the shakeout the castings are transferred to the cleaning department which is equipped with the usual tumbling barrel and sand blast equipment and motor-driven grinders and snagging machines. A complete machine shop is operated in conjunction with the plant, a modern planer, vertical boring mill, drill press, grinder and lathe, etc. being provided to finish castings according to exacting specifications.

Throughout the various stages of production the castings progress from one department to another in a straight-line course finally arriving at the shipping platform. The shipping yard is spanned by a traveling crane and is paralleled by a depressed railroad siding which permits cars to be spotted with their floors level with the shipping platform. A pattern storage and modern equipped electric repair shop is housed on the second floor of the main building. A physical testing laboratory also is maintained.

The chief aim of the No. 2 plant



PHOTOMICROGRAPH OF A WEAR RESISTING CAST IRON



PHOTOMICROGRAPH OF ALLOY HEAT RESISTING CAST IRON SUITABLE FOR FURNACES AND OVENS

is the development of electric furnace alloy cast iron and already a large number of castings have been placed on the market. These include die blocks, hammer dies, automobile parts such as pistons, cylinder blocks, special molds for the glass industry, heat resisting iron for furnaces and oven, and wear resisting castings such as pipe balls and piercing points.

In the manufacture of this material the Vulcan Mold & Iron Co. has found it advisable to use an electric furnace. Practically a complete recovery of the alloys is possible by this method due to high temperatures and the absence of oxidation. It also was found that on absolute control of composition could be made and that when the proper analysis for a given casting was found it could be duplicated readily. The desirable condition of low-sulphur content also was procured. Alloy iron of low-carbon content, almost on the border line between iron and steel, has been made with comparative ease. Melting takes place in the usual manner, the charge generally including pig iron and scrap steel; the alloys being added just before tapping the heat.

Numerous unusual properties have been produced in this iron by varying the amount of alloys and by changing the percentages of the ordinary constituents of cast iron. In castings of small sections it is possible

PHOTOMICROGRAPH OF ALLOY CAST IRON FOR PISTONS AND CYLINDERS HAVING FAST MACHINABILITY AT BRINELL 196

to produce an iron having a dense, close-grained structure, pearlitic in character, which can be machined readily at a high brinell hardness. This is accomplished by the elimination of hard spots, chilled corners and by having the graphite more evenly distributed and in a finer divided state. Castings of large sections have been made with only a slight variation in hardness from the outside to the center and machinable at normal speeds with brinell hardnesses of over 300. The castings are strong, tough and resistant to wear. Where high strength is desirable, castings have been made with a tensile strength on a standard test bar of over 40,000 pounds a square inch and a transverse strength of 4550 pounds.

Practical experiments on heat resisting alloy cast iron made with high percentages of alloys have shown a freedom from excessive oxidation at high temperatures. The experiment conducted under similar conditions of temperature and time on pieces of alloy iron and ordinary cupola iron made at this plant showed an oxidation loss of 2 per cent on the alloy metal and 30 per cent on the cupola metal. Only a few types of castings have been made since the plant was placed in operation, but the properties of the iron which have been determined indicate that there are a large number of castings to which this electric iron is especially adapted.

Book Review

Metallurgy of Cast Iron, by J. E. Hurst, 303 pages, cloth, 5½ x 8¼ inches, published by Sir Isaac Pitman & Sons Ltd., London, and supplied by THE FOUNDRY, Cleveland, for $4.50 and 2-3 Caxton House, Westminster S. W. 1, London, for 15s.

Exception is taken to a statement on the cover of the book which calls it a complete treatise dealing with the production and composition of cast iron. Much is lacking and the reader may be disappointed because, notwithstanding the position of the author in the field of centrifugal casting, sight mention is made of the process. Again in a chapter on permanent molds he mentions, but gives no description of the process developed by the Holley Carbuetor Co., Detroit, and entirely ignores the process developed by Schwartz in Cleveland. No reference is made to the casting of gray iron into heated molds as practiced first in Germany and later in other European countries, or to the process for making quailty cast iron developed by Thyssen and Emmel. Foundrymen and others interested in cast iron would like information on the aforementioned processes because they are new developments and show the trend in the cast iron industry.

It was the general impression in this country that the specter of the use of direct metal for castings other than ingot molds and the like, had been laid quietly to rest, but alas, it is dragged forth again in the opening chapter. In describing the effect of the various elements on cast iron, the author should have mentioned the work of Bolton and of MacKenzie on the effect of phosphorus.

For some unknown reason practically all books on the metallurgy of cast iron, this one included, refer to the use of scrap steel in charging the cupola to make what is known as semisteel. However, the most important feature of the details of melting additions in the cupola is left out as though it is a matter of common knowledge. Perhaps, it is in some quarters, but few foundrymen can melt a heat containing 25 to 30 per cent steel without running into difficulties unless they have been instructed by an expert in this pratice. Those foundrymen that do employ large quantities of steel scrap seem to be loath to describe exactly how it is done.

In the concluding paragraph of the book the author reports the use of pure copper as a permanent mold material in America. One of the few places that copper molds are used to any extent is at copper refineries for ingot making, because when the molds are worn out, they may be melted up with the regular charges of copper.

The first four chapters deal with the production and composition of pig iron, iron-carbon alloys, formation of graphite in iron-carbon alloys, and the constitution of these alloys under the microscope. Chapters V to X show the influence of silicon, sulphur, manganese, phosphorus, special elements, and dissolved or occulded gases on cast iron. The remaining chapters deal with heat treatment and volume changes, influence of the rate of cooling and casting temperatures, shrinkage and contraction, mechanical and physical properties, mixing of irons and special mixtures and permanent molds.

Sixty-seven tables and 116 illustrations are used by the author to summarize his work and that of others and to visualize examples mentioned in the text.

Study Specifications

An account is given of a study made on sieves tested at the bureau of standards in technologic paper No. 321. Investigation showed the desirability of changes in the specifications for the United States standard sieve series. As wire diameter appeared to have only a secondary effect in actual sieving, the tolerance in wire diameter was made liberal. Relation of other measured dimensions of sieve cloth to sieving results also is discussed. Revised specifications are given in letter circular No. 74.

How and Why in Brass Founding

By Charles Vickers

Encounters Pin Holes

We are making goose necks for radio loud speakers of cast aluminum and the problem we encounter is to eliminate pin holes which appear on the drag side of the castings as shown by the sketch sent you. These holes would be negligible in the ordinary run of castings, but cause us considerable trouble, as the article is subjected to a bakelite enameling process which exaggerates the holes.

Apparently the cause is the dropping of tiny particles from the core when set in mold. We have tried every way we know, dusting the molds and exercising the greatest care in setting cores in the mold, but still the holes will appear. The solution may be found in procuring the right kind of sand for the cores. At present we are using ordinary bank sand with compound and oil binder. Perhaps you can suggest some better combination?

The bank sand core is probably too *close* or compact and does not permit gases to escape quickly enough to allow the molten metal to lie quietly on the under side of the mold. Why not make the core largely of lake sand? It can be bonded with compound, any dextrin binder, and if there is any question of particles of sand dropping from the core, this can be made quite impossible by spraying the green cores lightly with molasses water, or a weak solution of water glass might be better.

When using the No. 12 alloy, the cores must not be made hard and compact, otherwise the castings will crack, but if the alumnium-silicon-copper alloys are being used, it is not necessary to make the cores any softer than for brass. As aluminum has only about one-third the weight of brass it is just that much more easily lifted from a sand surface than brass. While the weight of the latter when it is molten may overpower any surface gas and drive it into the sand, the contrary is the case with aluminum. If it dances or shivers against the sand, it is being made to act this way by rising gases, with the chances being good that some little inclusions will be found in the aluminum after solidifiation.

It is always advisable in cases like this, to give thought to the depth of sand between casting and bottom board; if this space is shallow and the board is sound and well bedded, where is the steam generated by the heat to go?

A swell on the casting as in the present case, allows the metal to flow into this hollow and generate steam between it and the bottom board. It might help matters to vent the bottom boards right at this point and give the steam a chance. This does not appear to be a case of porosity the metal, and the castings are probably being poured at a suitable temperature, but the cooler they are poured the better provided the castings are run completely.

Only One Method To Harden Copper

Do you know of any material in powder or acid form that will harden copper? I have been told that a laboratory in the New York district has developed a formula and material for the purpose. I have looked through several books on nonferrous metal practice and manipulation, but I can find no reference to anything of the kind.

To paraphrase a famous saying, there ain't no such animal. The rumor that some person has discovered the lost(?) art of tempering copper arises periodically. It travels hand in hand with another hardy perennial of the man who has been offered several million dollars by the Anaconda or the General Electric for a secret process that will permit the substitution of copper for steel. The apparently simple fact that rolled copper even without the secret treatment usually is quoted at approximately four times the price of steel does not seem to have any effect on the plausibility of the story. The best and practically the only way to harden copper is to first melt it in a crucible furnace, then add 10 pounds of tin to every 90 pounds copper. This method will yield a good, hardened copper. It is the only way in which copper may be hardened to produce a metal of any commercial application. Increasing the tin content will increase the hardness of the alloy. Bell metal with 20 pounds tin, 80 pounds copper represents the maximum hardness in a copper alloy. Tin is not a powder. It is sold in ingot form by any dealer in metals.

Gates Cause Trouble in Making Trolleys

We are sending a trolley wheel casting and would like to know why such castings crack over the inside core and how the fault may be corrected. Our foundrymen believe the fault is due to improper gating, as they have been successful in eliminating the crack by using a horn gate, but our objection to this lies in the fact that it checks production. Can some more simple form of gate be used and eliminate the crack? The alloy consists of copper 91 per cent; tin 7 per cent; zinc 2 per cent.

The foundrymen are correct in asserting the cracking is due to improper gating. It is a shrinkage crack and a horn gate corrects the trouble because it permits feeding of metal from the root of the sprue, to compensate for the shrinkage as the alloy congeals. We presume that four of these wheels are made in a flask and if so, the use of properly proportioned horn gates should not impede the production sufficiently to offset the advantages of getting a large proportion of perfect castings. The writer states this from experience in making such castings. However, the casting may be gated into the rim and the cracking circumvented by using a thick sprue with offsets tapering at a sharp angle down to the rim of the wheel and immediately over the gates. The addition of 0.25 per cent phosphor copper might help the situation.

While the alloy should be satisfactory the design of the wheel is open to criticism as it is heavier than necessary in the web, and this is one defect that adds to the chances of shrinkage cracks. Another thing is the weight of the rim due to the use of cores to make the grooves. These cores do not appear to fit the prints properly. An all-green sand made wheel is much neater and saleable we should think. The molding sand used is too fine, something on the order of a No. 1 Albany would give castings with less trouble from defects.

Bill Talks on Busses and Splitting Cores

By Pat Dwyer

CROSSINGS, frogs and switches with cast-iron centers figure occasionally in the collection when Bill's sales manager pulls in the drag net and paws around among the orders which a beneficient Providence and his own remarkable selling ability have attracted. Providence receives all the blame for the jobs which fail to show a margin of profit. Our hero the *s. m.* does not claim all the credit for the jobs which show a profit even though the operating force almost burst their individual and collective galls in pulling them out of the fire. He cocks his hat jauntily and modestly intimates in the proper quarters that if he only had proper support from the manufacturing department he could swing the world by the tail on a downhill pull.

The foregoing is not intended as an introduction to a controversy on the subject of prices, or a condemnation of sales managers for the manner in which sometimes they accept contracts that are welcomed in the shops as cordially as a porcupine would be in a man's bed, after a hard day's work. It is introduced simply to explain why Bill attended the recent exhibition held in our fair city by the makers of equipment connected with the American Electric Railway association. Bill was professionally interested in some of the equipment shown and kindly invited me to accompany him.

He had eyes for nothing but the castings, brass, iron and steel, either in the natural or assembled state. He pawed the highly finished pieces over lovingly and tried to find out who made them, also particulars about melting the metal and the kind of sand and methods used in their production.

He met with little success. The voluble gentlemen in charge of the various exhibits could and in fact did tell him how superlatively well adapted their pieces of equipment were for their particular purpose, but neither knew nor cared how they were made. They dismissed trifling details of that character as something entirely without significance. Their attitude was typified by a solicitor who tried to sell me a subscription to a magazine. I asked him if he read it himself.

"Naw," said he, "Why should I waste my time reading it? It takes me all my time trying to sell it!"

My attention was taken up particularly with the elaborate display of magnificent single and double deck busses shining in their brave new coats of paint and glistening metal work, regular poems on wheels. Descending for the moment to Bill's method of expression I declared they certainly were easy on the eyes.

"Well," said Bill, "I'll tell you. It all depends on where you are when you look at 'em. I saw one this past summer and if I had had an old fashioned blunderbuss at the time I should have been sorely tempted to shoot the tail end off it with a double handfull of slugs and old horse shoe nails. In strict justice I must admit that the bus or the driver were not to blame, but you know how it is in these moments of emotional stress, one is apt to act first and then try to hatch up an alibi afterward. Our weak human nature gets the upper hand and we say and do things that—."

"Oh, can the sermon," I interrupted, "I know all about your poor weak human nature. In all probability you were entirely to blame for whatever happened on the occasion to which you refer. However, if you wish to unburden your mind let us camp on one of these luxurious seats so kindly provided for the comfort of potential customers and most certainly not for mere curiosity seekers like ourselves. We can stay here until some person with more nerve than politeness chases us away."

" 'Pon my word," said Bill admiringly, "Sometimes you show gleams of almost human intelligence. I was just about to suggest the same plan. Your brilliant idea goes far to prove how association with a master mind sharpens the wits. Stick around for a while kid and I'll make a man out of you yet."

"Come in out of the rain," I retorted, perhaps a little sourly, "You're all wet. What about this adventure in which you went gunning for a motor bus with a blunderbus?"

"Your mind," said Bill tolerantly, "or to be exact, that intangible property of yours which you optimistically consider a mind, is hopping off on the wrong foot again. I did not say I went gunning for a motor bus. Would you mind bending one or prefferably both of your long ears in this general direction. Thanks you, not too close. The long hairs on the ends are rather ticklish. What I said—are your ears focussed properly? — what I said was that if I *had* a gun at the time I certainly should have been tempted to plant a flock of slugs among the tail lights."

"All right," I said, "All right, have it your own way. Before you are through, you probably will prove that the bus carried an armament of 16 heavy guns on both sides, a crew of 274 men, two torpedo tubes and a submarine ram and you cap-

OH! FOR A BLUNDERBUS TO SAY *AU REVOIR*

tured it single handed and towed it home behind your flivver. Go ahead. I'll listen to anything."

Bill smiled indulgently. He cocked one long leg over the other and calmly proceeded to fill an old black cob pipe with a handfull of real tobacco. He borrowed one of my matches and then puffed away contentedly until he had surrounded us with an evil smelling smoke screen sufficient to keep all prowling visitors at a respectable distance. I modestly hinted he could shoot now any time, I was all ears.

"Fold 'em up," quoth brave Bill flippantly. "Tuck 'em out of sight before some person trips over 'em. I was down in Providence, R. I. this summer attending to the master's business and while I was there I had occasion to visit a couple of towns in the neighboring state of Connecticut. The complete round trip to Providence involved less than 200 miles, but I had more trouble on that trip than I have had on journeys of ten times the distance.

"The story properly starts with the annual outing and clambake of the New England Foundrymen's association at the Pomham club. There was an event worth talking about, where they heated short hunks of pig iron instead of a collection of stones, to cook the clams. I'll tell you about the doings again when I have more time. Originally, I intended to take a train in the evening and ride to Waterbury, Conn., so that I might be on the job early in the morning. At the dinner I met an old friend from Hartford and he persuaded me, easily I admit, to accompany him on a bus and spend the night at his magnificent home on the outskirts of that charming hamlet, pop., about 200,000.

"In the morning I had to creep out from between the covers at 5:30 to catch an early, but exceedingly slow train which landed me in Waterbury about 9 a. m. Connecticut is one of the smallest states in the union. Also, it is one of the oldest and naturally I assumed that methods of transportation were available to enable me to skip like a grasshopper over all the territory I intended to cover and still leave time to make Providence that night. Did I did it? Oi! Such a foolishness qvestion.

"My first objective on leaving Waterbury at 10:30 a. m. was the little town of East Hampton, less than 50 miles as the crow flies. Unfortunately I am not a crow, although before the journey was over I began to feel I could qualify easily as a cuckoo. East Hampton is one of these shy exclusive places, like one of the English villages you read about, miles and miles away from a railroad or a trolley line.

"From Waterbury I rode in a trolley car to Meriden where I waited an hour for a second car to Middletown. Here I had to wait for an four and a half for a bus to carry me into East Hampton where I finally arrived at 3:30. A thunder, lightning and rain storm arrived about the same time and I had visions of continuing the remainder of the journey on a raft. I had neither umbrella nor rain coat and I anticipated a beautiful ending to a perfect day.

THE CLAMBAKE IS A HIGHLY CEREMONIAL AFFAIR

"The genial citizen I had come so far to see kindly advised me that the best route back to Providence was to take a jitney to Marlboro, thence by bus to New London which is on the main line of the New York, New Haven and Hartford railroad. Here I could catch a train almost any time for Providence. The storm still was raging, but the gallant little jitney rode the waves like a duck and landed me at a filling station and grocery store about 4:30.

"Just before my arrival the place had been struck by lightning which tore a hole in the ceiling, knocked a lad with a cake of ice in his arms from one end of the room to the other and caused three women to faint and fall on the floor. I asked one of the attendants what time the next bus would pass for New London. He said 5 o'clock, but in his excitement forgot or was too dumb to tell me that I would have to go out in the road and signal.

"I waited patiently until 5, naturally expecting that the bus would pull up to the door. Imagine my feelings when I saw the big brute go whizzing past all lighted up with red and green lights like a battle ship. The road was covered with water and the roaring wheels threw a sheet of spray 20 feet on either side. Almost before I could wink an eye it was tearing out of sight like the devil went through Athlone in standing jumps.

"When I stormily demanded an explanation the imitation human being who kept the place calmly informed me that the bus only stopped on signal. Can you beat it? A flag station on a main highway! To my further inquiry he remarked nonchalantly that the next bus was due at 9 p. m. My spirits dropped to 17 degrees below absolute zero. I was wet and hungry and I was morally certain that if I had to stay in that forsaken hole until 9 p. m. I would develop hydrophobia and run around barking and biting people on the legs. That was the time I wished I had a long range blunderbus.

"At the risk of being mistaken for a highwayman I walked out into the middle of the road and held up one hand to the driver of the first car moving in the right direction. He obligingly stopped and asked me suspiciously what I wanted. A good closeup of him and his car almost tempted me to pass him up and wait for another. The only excuse I could think of on the spur of the moment was to ask him the time and let it go at that. However, something seemed to warn me that this ferocious looking individual with hard eyes, a moustache like a section of a wire scratch brush and a set of mule teeth would not take kindly to the idea of being stopped in the middle of the road to answer such a silly question. More likely he would hit me over the head with a black jack or a shovel and tell me pleasantly it had just struck one.

"Taking my courage in both hands

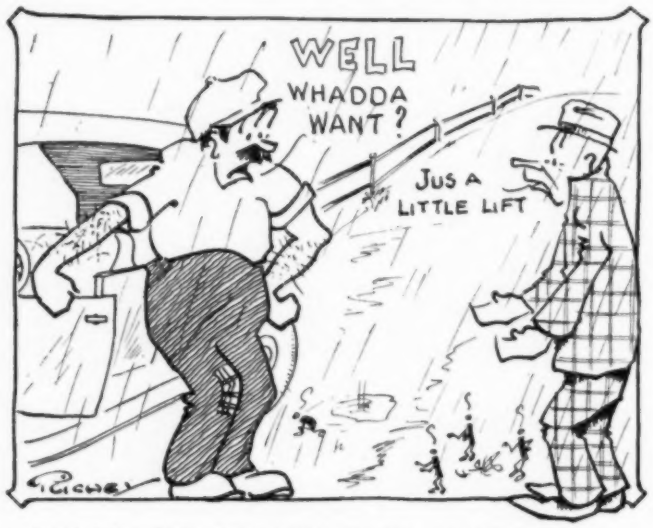
I hopped on the running board and briefly sketched my predicament. How easily we are mistaken in first impressions. He said he was only going about half way to New London, but he would be glad to give me a lift. I climbed in over the door which was fastened with a wire and found the floor covered with tools and miscellaneous builder's equipment. The old Cadillac was no beauty, but the engine apparently was as good as the day it left the shop. The lad stepped on her and hit a steady pace of 50 up hill and down. Boy, he was in a hurry. He skidded around slippery corners on two wheels in a manner that would have made Ben Hur green with envy. I was green too, most of the time, but not with envy.

"Finally we arrived at the point where he turned off the main road and he gave me the choice of getting out, waiting for another lift, or continuing with him to Willimantic. He intimated I had a chance of getting a train or a bus in that town. It looked like a case of six of one and a half dozen of the other. I stayed with him and rolled into Willimantic at 6 p. m. to find the last bus and the last train had left for the night. I stayed there all night and caught a milk train at 5 a. m. on the following morning. The distance to Providence is 57 miles and although we stopped to pick up every milk can in the states of Connecticut and Rhode Island we snorted into the station at 7:30. Believe me kid I could sympathize with Sheridan on his famous ride to Winchester 20 miles away.

"Talking about buses and wheels and things like that," Bill continued, "reminds me of an inquiry I had the other day from a lad who wanted advice about splitting plates. He said he had an order for a drum 60 inches diameter, 48-inch face weighing about 4 tons which had to be split in the mold. He craved advice on how to go about the job. He said he had tried to split a pinion 28 inches diameter, 16-inch face with a steel plate coated with blacking, but it failed to work.

"I pointed out that a single steel plate is not suitable for splitting a solid block of iron 28 inches in diameter. Even under the most favorable circumstances a coating of lead hardly could be applied thick enough to prevent the iron from fusing to the plate. However, the principal danger from employing a steel plate is due to the fact that the plate usually is coated with a thin film of scale or oxide. The blacking is applied to the plate and the moment the molten iron strikes the face of the plate the scale blisters off and takes the blacking with it. The result is an unprotected plate to which the iron readily unites.

"If he was forced to use steel splitting plates I suggested he use two, face to face. The adjoining faces to be coated with blacking to prevent fusion, but with the other faces deliberately cleaned so that they will fuse to their respective halves of the casting. Countersunk holes to be staggered over the face of each plate so that the iron will come through and help to anchor the plates in place. Care must be observed to see that the holes in one plate do not come opposite to those in the facing plate. In the great majority of cases a thin splitting core made from an oil sand core mixture will be found more satisfactory than a plate.



help! help! SAID OUR HERO IN HIS BRAVEST VOICE

"He did not state the thickness of metal in the drum, but I assumed that the casting was of the usual type with a double set of arms and a metal thickness of 1½ or 2 inches in the face. Plates may be employed for splitting this casting provided they first are cleaned and then coated on one side as previously mentioned with blacking. However, cores are employed freely for the purpose and taking all the factors into consideration probably are more convenient than plates.

"At one time a certain amount of prejudice existed in connection with thin splitting cores. The sand was bonded with flour, it was rammed hard, flour was used to excess to provide a hard, stiff core and they were not adequately vented. As a result blow holes developed in the casting in the vicinity of the cores. Sharp sand, bonded with an oil binder produces satisfactory splitting cores. Other proprietary binders also produce satisfactory cores for the purpose, if the coremaker is familiar with their characteristics and uses proper discretion in the amount he uses.

"Where cores are employed, they do not project through the sides of the casting. A certain thickness of metal is left intact. If the natural contraction of the casting does not split this small thickness, the metal easily is forced apart after the casting has been machined. In the drum under discussion the splitting core will project through the lugs and extend to within about ¼-inch of the outside face of the mold. The hub splitting core will split the hub to within about ¼-inch of the center core."

"That represents American practice," said Bill, "But it is rather odd to find how many things molders in many countries have in common. At the recent Detroit convention I met an exceedingly likable foundryman from Sweden. He told me of a funeral in his country at which the pallbearers were molders. Just as the coffin arrived at the bottom of the grave one big husky guy pulled his corner close to the wall of the opening and hoarsely whispered to the others 'Hard to me and sun about!' "

Establish New Mill

Fairmont Mfg. Co., Fairmont, W. Va., has established a modern rolling mill to manufacture aluminum sheets, coils, circles, strips and plate. Officers of the company are as follows: William J. Adam, president and managing director; Lawrence M. Brile, vice president and sales manager; Frank M. Brown, secretary and treasurer, and C. J. Wolfe, works manager. The general sales office will be located at 52 Vanderbilt avenue, New York, and will be in charge of Mr. Brile.

Dorman, Long & Co. Ltd., (Carlton Iron Works) has transferred its London office for ferromanganese and spiegeleisen to 305, Winchester House, Old Broad Street, London, E. C. 2.

FURTHER SAFETY WORK

Representatives of Iron and Steel Companies Take Prominent Part in Fifteenth Annual Safety Congress Held in Detroit

REPRESENTATIVES of iron and steel companies took a leading part in the discussions incident to the fifteenth annual safety congress of the National Safety council in Detroit Oct. 25-29. Their activities were centered in the meetings of the metals section. Clarence H. Howard, president, Commonwealth Steel Co., Granite City, Ill. was one of the principal speakers at the session devoted to industrial safety.

T. H. McKenney, Illinois Steel Co., South Chicago, and John A. Oartel, Carnegie Steel So., Pittsburgh, who have played prominent roles in the safety conventions many years, summarized some of their recent experiences.

H. A. Schultz, assistant manager, bureau of safety, sanitation and welfare, United States Steel Corp., New York,* advocated making every department head a safety director.

The session Wednesday morning devoted to "Tips Direct from the Shop" was featured by an address on averting foundry hazards, by W. C. Wright, National Founders' association, Chicago. Discussion was led by F. G. Bennett, Buckeye Steel Castings Co., Columbus, O. Frank W. Cramer, electrical engineer, Cambria plant, Bethlehem Steel Co., discussed some of the electrical hazards in the steel industry.

The round table discussion Thursday took the form of an educational forum on the merits of contests, posters, rule books, letters to foremen and use of lantern slides.

"Contests have been a great help in minimizing accidents at our plant," said J. A. Voss, safety director, Central Alloy Steel Corp., Massillon, O. "It is fundamentally right to apply the principle of co-operative effort to accident prevention, but the success depends on the ability to arouse and continue the superintendents', foremen's and employes' interest in the work. No means offers itself to so promptly arouse this interest and continue it as does the placing of accident prevention on a competitive basis.

The Youngstown Sheet & Tube Co. has had a safety rule book for 16 years, revised as circumstances required, James M. Woltz, the company's safety director, said. A copy of the book is given to each new employe, who signs a receipt, and thereafter he is held responsible for infraction of the rules.

E. G. Quesenel, safety engineer, Commonwealth Steel Co., analyzed the advances of using good posters. Actual specimens of letters sent to foremen touching on the enforcement of safety rules were read by Frank H. Rowe, safety director, Wheeling Steel Corp., Portsmouth, O. He placed safety letters in four classifications, letters of praise, of criticism, of information, and of general interest. The safety director often can impress his message on foremen more expeditiously by writing a letter, than by interrupting him in the regular course of his shop duties to talk with him.

Others who participated in general safety discussions were C. B. Auel, Westinghouse Electric & Mfg. Co.; Arthur T. Morey, general manager, Commonwealth Steel Co.; and H. W. Mowery, American Abrasive Metals Co., New York.

Walter G. King, New York, in charge of the safety activities of the American Optical Co. was elected president of the National Safety council succeeding Charles B. Scott.

Other officers elected are: W. F. Austin, Detroit, vice president for engineering; A. W. Whitney, New York, vice president for education; H. A. Reninger, Allentown, Pa., vice president for local councils; Charles E. Hill, New York, vice president for public safety; Dr. L. A. Shoudy, Bethlehem, Pa., vice president for health; C. E. Pettibone, Boston, vice president for industrial safety; H. E. Neisz, Chicago, vice president for public relations; H. M. Webber, Chicago, treasurer and vice president for finance; and W. H. Cameron, Chicago, managing director.

Safety Movement Needs Incentive

By Clarence H. Howard

This article by Mr. Howard, who is president, Commonwealth Steel Co., Granite City, Ill., was presented as a paper before the Detroit convention of the National Safety council, Oct. 25-29.

THE safety first movement, to be most effective, must have a common objective; one which all the units of the movement, or organization, see and understand. This objective should be so coupled with individual benefit and group benefit as to furnish the most powerful incentive toward individual and group effort. This simply is the adoption of the principle of right as the unerring law of action, and to apply the right way insures for us the right-of-way, for when causes are right, effects take care of themselves.

Only about 30 per cent of accidents can be prevented by mechanical safeguards; the other 70 per cent must come through the practical application of the *Golden Rule*, which is the positive, wholesome and constructive side of safety. Safety first, when properly analyzed, is the expression of fellowship and the *Golden Rule* and should therefore be considered only in the terms of the *positive*, that which gives buoyancy, confidence, strength, and courage. Its opposite, danger, is the negative, for it only expresses doubt, fear and discouragement.

To illustrate safety first as the *positive* and danger as the *negative*, let us think of danger as darkness, for they both are suggestive of fear, doubt, and confusion; and safety as light. One enters into a dark room with a light; immediately the darkness is extinguished for it is merely the absence of light. Now, where,

one may ask, did the darkness go? It did not break through the doors or windows getting out. The fact of the matter is that darkness never really existed as an entity but was merely the absence of something—the light. The negative is always the absence of something that is positive, true, and constructive. Therefore, as we stick to the positive side of safety we have the light of intelligent thinking, and there can be no accidents, danger, doubt, or fear where there is intelligent thinking.

A positive viewpoint of safety is one of the most important factors in reducing accidents. Accidents have no necessary part in the conduct of as successful business; they are unnecessary inefficiencies. Accidents were once considered inevitable but out of the nightmare of the past has emerged a safe, practical, and orderly condition in industry.

Safety first movement is one of the greatest constructive conservation movements that has come among men. Economic losses in the country through accidents have been almost beyond belief. There is nothing more useless than an accident; the victim, his family, his employer, and his community are the losers.

Safety first results in the scientific study of the right and orderly way of doing things, and the safety first movement has proven to be one of the greatest agencies toward the realization of the brotherhood of man. It develops high individual efficiency which results in greatest service, and when service is rendered confidence is earned and success is assured. Service must be expressed in safety, efficiency, and economy, and character building is its goal, which enables one to profit with his fellowman and community, but never at their expense—to live *in* a city and not *on* it.

The most important engineering course today is human engineering, and safety and fellowship is its basis, for if a man knows all there is to know about business and all other human activities, but has not a positive comprehension of safety and fellowship that he may work safely and harmoniously for and with his fellowman, how can he utilize what he knows?

The next important factor in safety first is that of poise, which has been splendidly defined in the following:

"Poise is that state of consciousness which is at rest and peaceful when no one praises, and undisturbed when opposed, censured, or misunderstood."

To lose one's poise because of any disturbed condition is not safe and only makes a bad thing worse.

A broad gaged, public-spirited citizen must be intent, uniform, consistent, and compassionate. When difficulties and misunderstandings arise he must be wise, brave, unselfish, and compassionate which will awaken a spirit of fellowship and thus express for himself and his fellowmen an atmosphere of safety.

The Constitution of the United States does not imply that arbitrary human force resulting in fear shall regulate man. Rather it does imply that righteousness shall permeate our laws and our relations. Mankind will be rightly and therefore safely governed in proportion to the utilization of the *Golden Rule* in law and its practice, in industry and in commerce, thus insuring the rights of man and holding sacred the liberty of conscience, and manifesting the *positive* side of safety first.

Western Foundry Averts Accidents

By T. F. Jennings

THERE is, there can be, no greater, grander, nobler, aim than that of alleviating, and so far as humanly possible, preventing, the pain, sorrow, and misery of life incident to industrial activity.

In 20 years, the movement to prevent industrial accidents has become almost universal in its influence, and is a recognized integral part of every modern industrial organization. This is true of the Utah Copper Co. with which the writer is connected, and which company operates at Bingham Canyon, the largest open cut copper mine in the United States and operates at Magna and Garfield, reduction and concentrating mills having a capacity of 40,000 tons a day.

Report All Accidents

Whenever the departmental safety committee finds that an accident has been caused by any mechanical defect, or danger incident to any place of employment in the foundry, that committee forthwith so reports to me, as superintendent of the foundry, and steps are taken to have the situation rectified. The work of the departmental safety committee is augmented by that of a special foundry equipment inspection committee, composed of experienced foundrymen, appointed by me on that committee in recognition of their qualification and competency to pass upon the safety of the various machines, appliances and tools involved.

Whenever, in that foundry, a heavy object has to be elevated above the floor level, and men work under such elevated object, they are specifically required to place beneath each end of the object blocks up to such height that if the object should drop it would strike and rest on the blocks, rather than crush or injure the men.

Use Tapered Trunnion

When large flasks are lifted by cranes, with a view to turning the flask over, the use of square headed trunnions is dangerous, because the crane sling is liable to slip off the neck of the trunnion onto the head, and when the employe goes to turn the flask, the sling, being insecure, may slip off the trunnion entirely and drop the flask on the employe. We avoid that danger by having our trunnion heads tapered to an edge. When such a tapered trunnion is used, if the crane slings slips it must either remain on the neck of the trunnion or slip entirely off, and thus drops the flask before the employe has occasion to pass under it or around it. In other words, with a tapered trunnion the sling must automatically not operate at all, or else operate safely. This practice in itself removes the hazard of some of the most serious accidents that are incident to the foundry industry.

Averts Accidents

ACCIDENT prevention now is recognized as a necessary adjunct to the successful operation of industrial concerns, either large or small. In the foundry industry, many hazards have been eliminated during the past 20 years through intensive safety campaigns, safety equipment and continual schooling of the employe in safety measures. This article is abstracted from an address at the recent Industrial Accident Prevention conference in Washington. The author, T. F. Jennings, is superintendent of the foundry of the Utah Copper Co., Garfield, Utah.

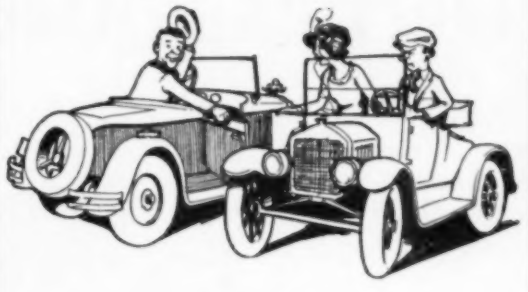
The danger of flying particles from the grinding machines is decreased by the position of a thick glass screen between the operator and the machine. It may be thought by some that the existence of that glass screen increases the danger where the wheel itself breaks when the machine gets choked. This contingent danger is minimized by the use of an adjustable platform, which platform can be adjusted so that the edge thereof will be in proper relation to the wheel, and thus prevent the occurence of spaces into which the metal might otherwise drop and coke the wheel. At the same time, the use of this platform relieves the lifting or holding strain on the operator, and thereby lessens fatigue. All hand tools are regularly and frequently inspected, and care is exercised to avoid the use of weak, cross-grained or splintered handles. When a head becomes mushroomed, chipped or cracked, it is promptly laid aside and not used again until it has been ground down or forged into proper shape. Similarly, chisels and other small tools are sharpened frequently and the burrs kept ground off. All steel hand tools that are liable to be struck by hammers or sledges have the upper part of their shanks tapered from the top downward before they are used at all. Experience has proven that a tapered head, smaller than the body of the tool itself, will not mushroom as quickly as a flat head equal in surface to that of the body of the tool.

No employe is allowed to pour molten metal without wearing standard safety goggles. All chippers and furnacemen likewise use them. The rules requiring the employment of such goggles are strictly enforced.

A special assigned crane expert inspects the limit switches on the cranes every morning, and the departmental inspection committee also devotes special attention to the chains and other equipment on the cranes. Each craneman is furnished with, and is required to comply with, a code of rules governing the operation of the crane, which code has been worked out by myself and associates from long experience.

In our foundry is the largest chill machine of any of which the writer has knowledge. It is 122 feet long, and we cast 72,000 pounds of metal every day. It can readily be appreciated that if that machine is cold, or damp, the danger in its use would be immeasureable. That machine is carefully inspected daily, and is preheated and dried, and by the use of these precautions that machine has been operated for two years without a single lost-time accident. We employ from 120 to 250 men, and cast from 40 to 50 tons of molten metal per day, and yet for a period of eight months past have operated without a single lost-time accident.

Faked Foundry Facts



A Shift

Extension Course Deals With Foundry Work

An engineering extension course consisting of eight lectures and demonstrations dealing with the practical phases of foundry work has been arranged for the foundrymen of Northern Indiana by the engineering extension department of Purdue university, West Lafayette, Ind. The meetings will be held each Tuesday night starting Nov. 30 at the Mishawaka high school, Mishawaka, Ind.

The course is intended for the practical foundryman who is interested in learning more about the various phases of the foundry business. A brief outline of the course is as follows:

Manufacture of Pig Iron—Illustrated lecture tracing the raw materials from the mine to the finished product.

Metallurgy of Cast Iron—Composition of cast iron. How carbons are effected by rate of cooling. Effect of silicon, sulphur, phosphorus, manganese. Table of analysis for different castings. Semisteel, annealing cast iron. Shrinkage, segregation, tests. Theory of solution, critical temperature.

Cupola Construction — Different locations of tuyeres and why. Location and size of slag hole. Preparation of Cupaola, charging melting. Blast pressures regained. Cupola troubles, cold iron, oxidized iron, bridging, freezing up.

Foundry Sands—How sand occurs in nature. Sand analysis. Preparation of sands for various classes of work. Other foundry materials.

Molding and Core Making—Advantage of different core binders and when they should be used. Baking temperatures. Treatment of cores after baking. Producing cores at small equipment expense. Ramming by hand, by machine. Gates and risers. Special methods of venting, securing, pouring. Formation and escape of gases. Use of chills. Methods employed to encourage even cooling.

Permanent Molds — A complete review of the permanent mold, from the earliest attempts to the present day.

Drawings for Shop Use—Kinds of drawings. How made and why. How to read drawings, lines dimensions, symbols, etc. Value of intelligent use of drawings.

Foundry Planning—Value of Time Study—Elimination of peak loads. Classification of product. Wage incentive promotion. Standardization of equipment. Lowering labor turnover. Reduction of overhead. Use of charts. Systematic production control. Controlled inventories.

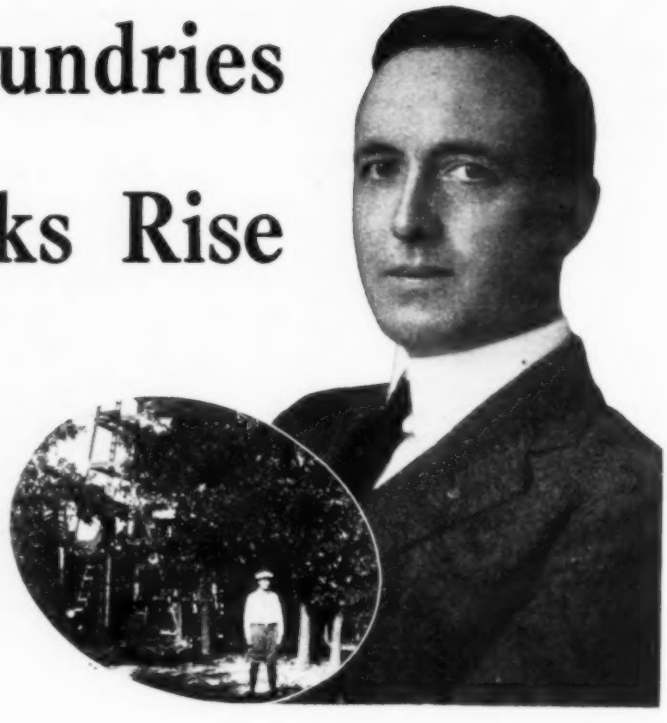
The administration of the course will be under direction of George W. Gilderman, superintendent of foundries, Dodge Mfg. Corp., Mishawaka. He will be assisted by J. D. Hoffman, head of the practical mechanics department, Purdue university; D. C. Turnbull, chief engineer, Dodge Mfg. Corp.; H. A. Schwartz, American Foundry Equipment Co., Mishawaka; L. M. Zimmerman, Dodge Mfg. Corp., and Cornelius Abbott, vocational director, Mishawaka.

Booklet for Foundrymen

American Foundry Equipment Co., Mishawaka, Ind., has published a booklet containing illustrations of men in the organization who are engaged in the production and distribution of its sand cutters and other foundry equipment. Facsimiles of letters from users of the firm's sandcutters are included.

Herbert H. Klein, formerly Massachusetts representative for J. W. Paxson Co., Philadelphia, now is associated with E. P. Sanderson Co., Cutter & Wood Supply department, Cambridge, Mass. He will be in charge of foundry supply sales.

Builds Steel Foundries *Where the* Towering Derricks Rise



WHEN Ernest H. Cornelius set about building a steel casting plant in Tulsa, Okla., in 1920 his friends figuratively washed their hands of him. They nodded their heads resignedly and said it was a pity that such a clever young fellow, a young man of promise and native ability should attempt such a hare brained experiment. They trusted sincerely, after the manner of dear friends, that when he went broke it would be a lesson to him and to any others who strayed away from the main business of Oklahoma which as all the world knows is boring wells and collecting the flowing black gold which gushes spontaneously from this specially favored section of the earth.

Ernest's middle initial is *H* which may stand for *handful* and then again it may represent the two principal words in the famous old motto *To Have and To Hold.* His present business activities would be reckoned a fair to middling handful even by those who are accustomed to long lines of figures. Thrown upon his own resources in early life he soon discovered that to have a job is one thing but to hold it is a much more satisfactory test of one's ability. The first heat of steel from his new foundry was tapped in August, 1922, and for a year thereafter progress was slow. However, the hold never was relaxed and for the past year or two the plant has been taxed to its capacity of 250 tons a month. A second plant is just about to start operation in Houston, Tex.

Hastings, Nebr., was the town selected by the future foundry owner and Oct. 28, 1890, was the day on which he decided to give this earthly form of existence the well known double-O. Apparently the investigation was satisfactory. He is going stronger with each succeeding year although his youth was greatly handicapped by sickness that prevented him from taking part in the usual sports and activities of that period of life. He finished high school at 17 and then attended Northwestern university for 2½ years. Injuries sustained here caused his father to send him to California for a period to recuperate. About the same time he—the father, of course—cut off his allowance and for the first time in his life the young man realized that money is a desirable commodity, in fact an actual necessity.

The second step in this new chain of reasoning showed him that the best and surest way to insure a constant supply of this sovereign remedy for practically all the ills of man and beast, is to earn it. Not to put too fine an edge on it, he decided to go to work. Also he determined to finish his interrupted university course. Economic conditions suggested he should finish in Nebraska State university in the old home town rather than in aristocratic Evanston on the outskirts of that wicked and expensive city of Chicago. He lived at home, put on the old overalls, built houses and did a bit of general contracting in the two years required to complete a course in civil engineering.

With the sheepskin in hand he descended—yes, descended is the word—upon Kansas City with the magnanimous intention of placing his services at the disposal not necessarily of the highest, but the most worthy bidder either in Kansas City, Kans., or in Kansas City, Mo. Absolutely no favoritism was to be shown either to the right or left bank of the muddy Missouri river. He waited for a week in vain at one of the leading hotels for the clarion call that would summon him to a responsible and highly lucrative position. Apparently he had arrived during the closed season. Big business was not calling.

The following year nearly nipped the embryo young engineer and captain of industry in the bud. He left the expensive hotel and secured a modest little room in a secluded neighborhood while he scouted around the town for a job, any kind of a job. Finally he landed one as a drafts-

man with an architect, but was fired almost as promptly as he had been hired. The boss was a kindly man. He told our hero he was no draftsman. His forte plainly was decorative art. He suggested that the job of ticket painter in a Chicago laundry would just about fit him.

His next job was as salesman in the Texas territory for a small steel company. The company went bankrupt and although no person ever tried to fasten any of the responsibility or the credit on the sales force collectively or individually—well, you know it sure does beat all how a jinx hangs on to a man when it gets a grip. Stranded in Texas, stony broke without either money or position the husks of Kansas city presented sufficient attraction to cause him to borrow enough money to pay his fare back. A young man earning the princely wage of $18 a week shared his bed and gave him 25 cents a day for food and carfare until he secured a splendid job. Secured? Nay rather he snapped at a magnificent job paying $3 per night checking railroad car weights in the east bottoms of Kansas City. The job not only saved his life but gave him an entirely new vision of what, who and where he was.

Shortly after getting down to bed rock he became connected with the Kansas City Light & Power Co., and afterward in turn with the Metropolitan Street Railway Co., and the Kansas City Southern Railroad Co.

Lure of the great oil-well country carried him to Tulsa in 1916 where he assumed the duties of contracting engineer with the Oklahoma Structural Steel Co. Within three months he was in charge of the plant.

After waiting a year he started a structural steel business of his own on a borrowed capital of $500 and in four years ran the annual volume of gross sales up to $250,000. He still owns this company, but has placed the management in other hands for several years. Developing the steel foundry business has occupied the greater part of his time recently, but he finds time occasionally to buy an oil lease or two, develop it to some extent and then sell it for a fabulous amount. He has lost all desire to return to Kansas City.

Demonstrates New Welding Method

AS ALLOY steel comes into greater prominence, it will carry with it the development of the hydrogen arc method of welding, according to P. P. Alexander of the General Electric Co. in a talk before the annual meeting of the Boston section of the American Welding society held Oct. 21 at the River Works plant of the General Electric Co., West Lynn, Mass. Nearly 200 members of the section gathered in the afternoon to witness the first public demonstration of this new method of arc welding. This was followed by a demonstration of the cutting of steel with city gas.

Following the demonstrations the members gathered in an assembly room at the plant where they were welcomed by W. G. Mitchell, assistant manager of the River Works. Mr. Mitchell gave a brief outline of the importance of welding in General Electric Co.'s production of electrical apparatus.

Comfort A. Adams, Harvard university, Cambridge, Mass., told of the remarkable welding research work now under way at various engineering schools. He praised research work in general, and said that most of the progress in the welding industry was closely linked with the developments in research laboratories. In the actual practice of welding it is necessary to combine so-called theory with application, according to Prof. Charles S. Park, who spoke on the teaching of welding in schools.

Research engineers at the General Electric Co. during the past year have developed a method of arc welding within a flow of hydrogen or other shielding gas. Mr. Alexander was one of the engineers closely identified with this development, and his paper on hydrogen welding was exceptionally interesting. "Although the process is called hydrogen welding," said Mr. Alexander, "a better name would be shielded arc welding for we have used many gases other than hydrogen in our experimental work. We have even used a completely inert gas such as argon, and will probably not use pure hydrogen in the perfected process."

Shielded arc welding consists briefly of drawing an arc between either carbon or metallic electrode and a plate and surrounding this arc by an insulating gas envelope. In practice the metallic electrode is used. This is fed through the center of a tube of larger diameter. This gas, which is to form the shield, then flows through the space between the electrode and the larger tube. Welds made by the shielded process show a much greater elongation without loss in tensile strength it is claimed.

Speaking on the subject of What's Next In Welding, C. A. McCune, American Chain Co., Bridgeport, Conn, said that he thought the most important need in the industry was a satisfactory nondestructive test. Next in importance he put the need for apprenticeship courses for welders and following this the need for better base metal. He said whenever there is a defective weld either the operator or the electrode was blamed, but never the quality of the base metal. Tests, which his company have conducted, show that the properties of the base metal are extremely important, and Mr. McCune advises purchasing base metal as well as electrode wire on some more extensive basis than merely the chemical analysis. He advised the use of microscope analysis. Research engineers at the plant of the American Chain Co., according to Mr. McCune, have recently devised a method of using the cathode ray tube in connection with high magnetic field to actually make interior strains in steel visible to the inspector. This method he predicted would soon be developed to a point of practical application.

To Market Recuperator

The refractory division of the Carborundum Co., located at Perth Amboy, N. J., has been licensed to sell a recuperator developed by W. H. Fitch. The new recuperator is adapted to reversing and nonreversing furnaces of all types used in various industries. Mr. Fitch, formerly associated with the metallurgical department of the Fuller-Lehigh Co., Fullertown, Pa., now is connected with the Carborundum company.

Connected with Engineering Department

Through an error in the Sept. 15 issue, L. D. Piek was reported to have been chief engineer of the W. W. Sly Co., Cleveland. Mr. Piek was connected with the engineering department of the Sly company, but not in the capacity of chief engineer.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ They Also Do Their Share

NOW that foundrymen have returned to the scene of their accustomed labors they are in a favorable position to view the recent convention in retrospect and compare the different features which principally attracted their attention. The multiplicity of technical papers presented naturally limited the discussion which they deserved and which undoubtedly they would have drawn forth under other circumstances. Back again in the familiar daily routine, or resting quietly at home with a copy of THE FOUNDRY containing many of the papers presented, the ex-Detroit visitor can start and stop the program, or to use the most familiar illustration, he can run imaginary film through his mental projector at any speed to suit his convenience. It is to be regretted in many instances that he cannot reproduce in full detail some of the mechanical devices and equipment which aroused his interest and, perhaps enthusiasm when he saw them in operation at the exhibition.

WHERE a man is an owner or has absolute power to buy any mechanical device that meets with his approval, a decision easily is reached. In a great many instances this condition does not obtain. The man who actually has seen the machine, device or piece of equipment in operation has to convert others to his views and the process of conversion in the majority of cases proverbially is slow. No description ever spoken, written or printed can equal the impression a man receives through his own reliable two eyes.

All the progress in the foundry industry is not marked by the papers read at the various sessions of the convention . Out in the adjoining buildings the manufacturers of supplies and equipment give practical demonstration of what they have done during the preceding year to make two castings grow where one grew before or to make two castings grow for the former cost of one. Sometimes they have succeeded on both counts. Who is to say that the contribution of the equipment manufacturer is not as essential and important as the most abstruse researches of the scientific investigator. In the last analysis one is complementary and essential to the other. One plans a process or a method and the other supplies the tools and equipment for converting a dream into a reality.

¶ Everybody Gains

ALTHOUGH the electrical energy generated in the United States is greater than in all other countries of the world combined, 13,500,000 families in this country have not been supplied with electrical facilities. With the possibility of carrying light to this vast army of non-users and with the application of electrical power in industry steadily gaining, the future for the electrical public utility in this country appears bright for years to come.

In looking back over the 44 years of progress since Thomas A. Edison built his first electrical generating station in New York, a foundryman cannot help but feel that his industry has been a vital factor in building the little generating station into one of the nation's greatest industries. Specifications have become more severe but the foundryman has met them all.

GIGANTIC central stations, either steam or hydroelectric, with enormous generating units would not be possible without the use of castings. Few uses could be found for electrical energy if castings could not be made to build the motors and other devices using electrical current. Research that has been conducted in the foundry industry has enabled the foundryman to meet the demands placed on cast parts in electrical machines by the designers of electrical equipment.

On the other hand, the growth of the electrical industry has increased the market for castings tremendously. However, a great demand exists for the extension of electrical power lines and for machines using electrical equipment, and if the foundryman and electrical engineer continue to work hand-in-hand in solving their various problems, both will benefit.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

CARE AND MAINTENANCE OF WIRE ROPE

HOW TO SOCKET WIRE ROPE

In socketing a wire rope, measure back from the end of the rope a distance equal to the length of the tapered basket of the socket. Tie securely at this point with soft iron annealed wire and add two additional tie wires below the first.

Open up the strands as in Fig. 8 of the accompanying plate and cut out the hemp core as far down toward the tie wire as possible. Unlay each wire and straighten so as to form a *brush* as in Fig. 9. On large ropes and heavy wires it would be necessary to place a small pipe over each wire to straighten or approximately remove the curl from the wire.

If the wires are greasy, hold the *brush* over a pail of gasoline (with the wires held downward) and wipe off the grease with waste or a paint brush dipped in the gasoline. Wipe dry, using a clean rag or piece of waste.

Dip the *brush* still holding the wires point down, into a pot of muriatic acid solution containing 50 per cent water and 50 per cent commercial acid. Insert the brush to a depth so as *not* to immerse the end of the hemp core. Keep in the acid until the wires are clean. Still holding the wires downward, withdraw from the acid and knock the rope sharply with a stick, broomstick or hammer handle.

Place a temporary tie wire as in Fig. 10 over the ends of the brush taking care not to handle the cleaned wires with greasy hands or tools.

Insert the rope end into the socket, then cut the temporary tie wire.

Set the rope vertically in a vise; adjust the socket so that the wires come flush with the top of the basket of the socket, then spread the wires out. Seal the bottom of the socket with fire clay or asbestos, as in Fig. 11. If cold, warm the socket moderately.

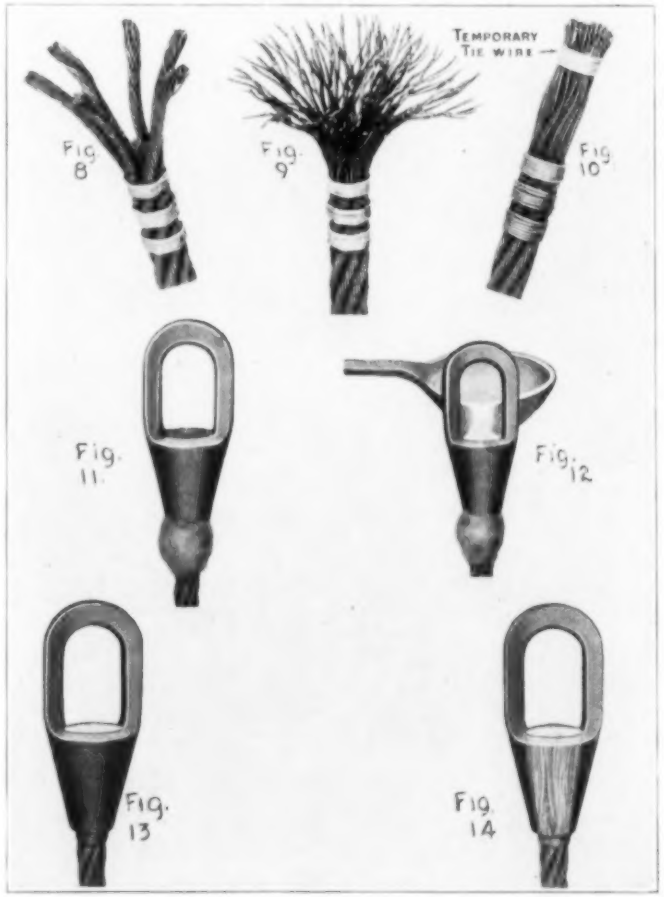
Pour with pure zinc, *not babbitt, lead or other alloy* as in Fig. 12. Tap the side of the socket with light hammer while the zinc is still fluid, so as to jar the zinc into crevices between the wires. When cool, remove the fire clay and the serving wires, and the joint as in Fig. 13 will result. It will help slightly in the flowing of the zinc among the wires to put a small quantity of salammoniac crystals over the wires just prior to pouring the zinc. Figure No. 14 shows a phantom view of the zinc cone with imbedded wires.

(*Concluded on Data Sheet No. 646*)

CARE AND MAINTENANCE OF WIRE ROPE

HOW TO SOCKET WIRE ROPE

(*Concluded from Data Sheet No. 645*)



FIGS. 8-14—SOCKETING AS EXPLAINED HERE GIVES THE STRONGEST AND MOST UNIFORM RESULTS. ONLY PURE ZINC IS USED

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

Around the World with The Foundry

Little Journeys to the homes of our readers

Korea

WALLED in by the barriers of nature in the shape of mountain ranges on the north and by a treacherous sea on the remaining three sides, Chosen, Dawn Land, remained distant, secluded, mysterious, unknown to western nations for over 2000 years.

The only white men who ever reached the country until well beyond the middle of the 19th century were the unfortunate crews of vessels caught by typhoons in the far Pacific, whirled up through the maze of islands extending from the southern tip of Japan to the Philippines and then dashed to pieces on the rocky walls of Korea facing the Yellow Sea. These men never came back. Evidence gained in later years when the nests of pirates and freebooters were cleaned out, indicated the probable fate of foreign seamen who may have gained a landing, alive.

It was the last of the far eastern nations to have peaceful dealings with foreigners when in 1882 the treaty ports of Chemulpo, Fusan and Yuensan were thrown open to the United States and in the following year to Great Britain and Germany.

The country has adopted western ideas in many ways in recent years including modern foundry practice and her progress in this respect has been due to a certain extent to THE FOUNDRY which is consulted twice a month by the executives of two of her leading casting plants.

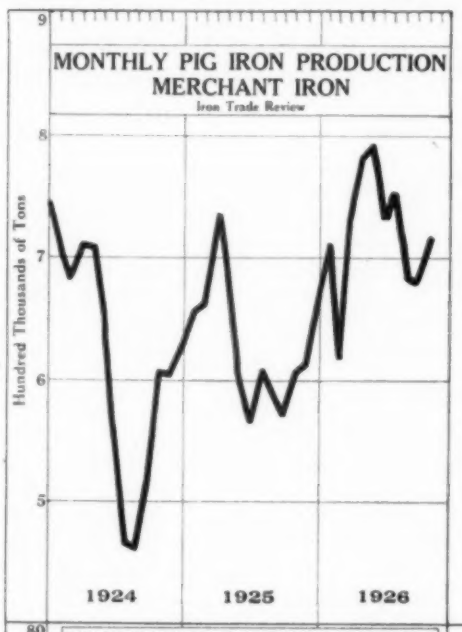
"Wherever metals are cast you'll find THE FOUNDRY"

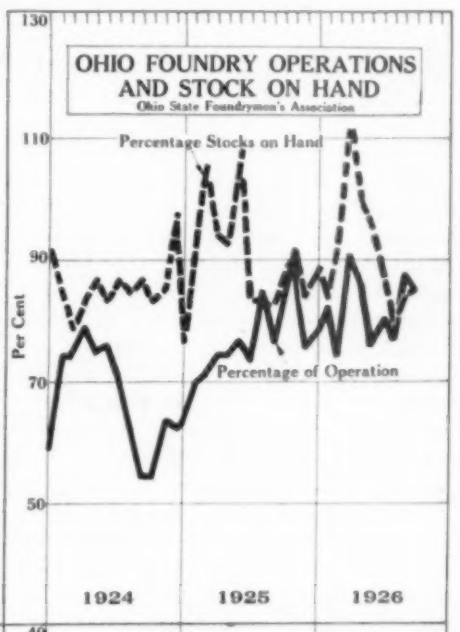
Trade Trends in Tabloid

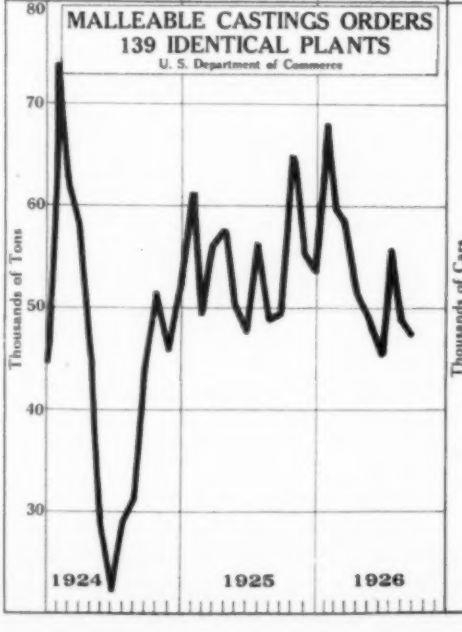
FOUNDRY activity is well sustained, but the prevalent complaint of low prices is heard in practically all lines. With the exception of railway equipment, the outlook for business from sources which provide the main demand for foundry products, is fair. Pig iron output showed an advance in October, according to the *Iron Trade Review*. The total production is given as 3,331,177 tons, compared with 3,163,269 tons for September, with the year's production practically a full month ahead of last year. Merchant iron output in October was 713,353 tons compared with 684,420 tons for the preceding month. Increases in coal prices, although coke has not followed the upward trend, have threatened higher pig iron prices. The steel industry is active. Car loadings continue at a high record. Building activity in the East is sustained by commercial construction, although residential building is slack. The value of new building contracts awarded the last week in October were higher than the previous week or the same week, 1925. Average prices for nonferrous metals in New York during October, according to the *Daily Metal Trade* follow: Casting copper, 13.80c; electrolytic copper, 14.127c; Straits tin, 70.283c; lead, 8.393c; antimony, 14.182c; aluminum, 27.00c. Zinc was 7.35c, E. St. Louis, Ill Nonferrous foundries, particularly plumbing goods shops are busy.

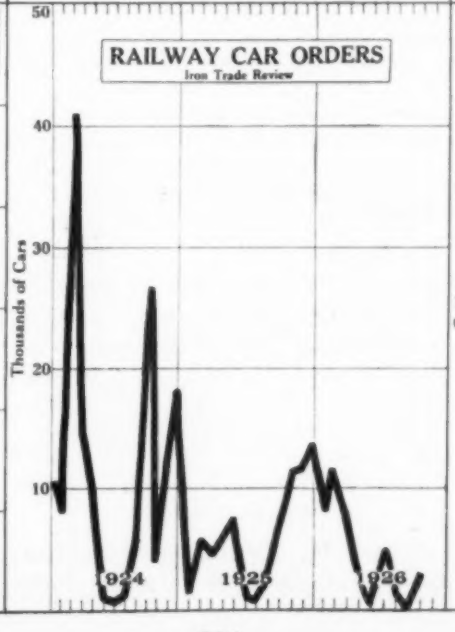
RAW MATERIAL PRICES
Nov. 6, 1926

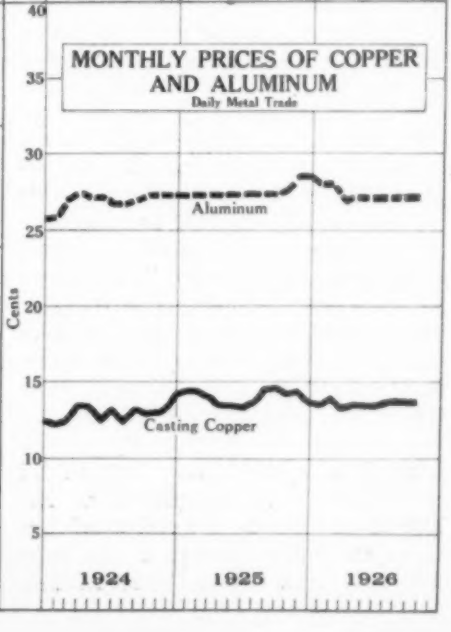
Iron	
No. 2 foundry, Valley	$20.00
No. 2 southern Birmingham	20.00
No. 2 foundry, Chicago	21.00
No. 2 foundry, Philadelphia	22.76 to 23.26
No. 2 foundry, Buffalo	20.00
Basic, Valley	18.50 to 19.50
Basic, Buffalo	19.00
Malleable, Chicago	21.00
Malleable, Buffalo	20.00
Coke	
Connellsville foundry coke	$6.00 to 7.00
Wise County foundry, coke	6.00
Scrap	
Heavy melting steel, Valley	$16.00 to 16.50
Heavy melting steel, Pitts.	17.50 to 18.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	14.00 to 14.50
No. 1 cast, New York	14.50 to 15.00
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.50 to 18.00
No. 1 cast, Pittsburgh	16.00 to 16.50
No. 1 cast, Birmingham	16.00 to 17.00
No. 1 cast, Buffalo	16.00 to 16.25
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.75 to 15.25
Railroad malleable, Chicago	16.25 to 16.75
Agricultural, mall., Chicago	15.25 to 15.75
Malleable, Buffalo	17.50 to 18.00
Railroad Malleable Pitts	17.00 to 17.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.60
Electro copper, producers	13.87½ to 13.95
Straits tin	69.00
Lead, New York	8.00
Antimony, New York	13.00
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	25.50
Aluminum, No. 12 remelt	22.50 to 23.00
Zinc, E. St. Louis, Ill.	7.17½ to 7.20











Comings and Goings of Foundrymen

THOMAS MAKEMSON, who recently was elected secretary of the Institute of British Foundrymen, as noted in the Nov. 1 issue of THE FOUNDRY, served apprenticeship as a patternmaker and later was interested in training apprentice patternmakers. He also is a technical man and has been associated with the Institute of British Foundrymen since 1917. Mr. Makemson was born in December, 1889, at Workington, Cumberland, and was educated at the Workington Higher Grade school and at a private school. He served apprenticeship as a patternmaker with the firm of John Milburn, Workington, and in 1911 became employed by the British Westinghouse Electric & Mfg. Co., Manchester, now known as the Metropolitan-Vickers Electric Co. Later he became interested in the apprenticeship of patternmakers and molders, and found a favorable field at the Westinghouse Works school where he organized classes. After conducting these classes for a few years he became associated with the company's educational department in a full time capacity and was responsible for organizing apprentice training in several departments of the works, particularly the foundries and pattern shop. About 2½ years ago Mr. Makemson was transferred by the Metropolitan-Vickers Co. to its research department as a process engineer with technical supervision of materials and shop processes, which position he still holds. Mr. Markemson commenced his technical training by taking evening classes in engineering at Workington and continued these at the Manchester College of Technology. He then took the complete metallurgical course at the same institution and received the diploma of associateship of the college a few years ago. In 1922 he was elected secretary of the Lancashire branch of the Institute of British Foundrymen. He is an ex-officio member of the general council, a member of the finance committee and convenor of an informal committee of all branch secretaries. He was associated intimately with the recent establishment of the Lancashire branch junior section, of which he now is vice president. Mr. Makemson also is a member of and takes an active interest in the British Cast Iron Research association.

Clyde N. Arnold, recently appointed chief metallurgist of the Lewis Foundry & Machine Co., Groveton, Pa., had been assistant metallurgist of the roll and machine works of the American Sheet & Tin Plate Co., Canton, O.

THOMAS MAKEMSON

William Louden, president of the Iowa Malleable Iron Co., Fairfield, Iowa, and founder of the Louden Machinery Co., was honored at a birthday party given him by the Rotary club of that city on Oct. 15. Mr. Louden is 85 years old.

John P. Williams, vice president of Pratt & Letchworth Inc., Buffalo, maker of malleable and steel castings, has resigned after 20 years service to become vice president and manager of sales of the Ontario Biscuit Co., Buffalo. Mr. Williams is president of the Buffalo chamber of commerce, and is active in other organizations.

Ralph M. Shaw has been appointed a director of the United States Cast Iron Pipe & Foundry Co., Burlington, N. J. He is a member of Winston, Strawn & Shaw, Chicago, and has been associated with the United States company as general counsel since its organization.

Victor W. Hain, formerly general superintendent of the Bergstrom Stove Co., Neenah, Wis., now is connected with the Hamilton Foundry & Machine Co., Hamilton, O., as production manager. Mr. Hain has been associated with the foundry industry for 16 years and has been superintendent of the Clinton Furnace & Stove Co., Clinton, Ind.; general superintendent of the Marshall Furnace Co., Marshall, Mich.; assistant superintendent of the Rudy Furnace Co., Dowagiac, Mich., and for a number of years was associated with the Beckwith Co., Dowagiac, in the capacity of a minor executive.

Newark Foundrymen Hear Addresses

Nearly 100 members and guests attended the meeting of the Newark Foundrymen's association which was held recently. Dr. Richard Moldenke Watchung, N. J., gave a review of foundry conditions in Europe which he observed on a trip made earlier in the year. He stated that alloys are being used in gray iron founding much more than in this country and that more technical men are employed.

Dr. Moldenke described some experiments carried on in foreign countries in developing superheated iron. Morden Grindal, Norwegian Foundrymen's association, spoke briefly on the industry in Norway. President Carter outlined the activities of the association in cost work and apprenticeship.

A. J. Rossi Is Dead

August J. Rossi, consulting chemist of the Titanium Alloy Mfg. Co., and the Titanium Pigment Co., Niagara Falls, N. Y., died recently after an illness of three days. He was born in Paris, France on Oct. 22, 1839 and was graduated from the Ecole Centrale of Arts and Manufactures, Paris, and received a degree of bachelor of science and letters from the University of France. Dr. Rossi was assistant engineer for the M. & E. railroad from 1862 to 1864. From 1864 to 1876 he was chemist for the Bornton War Works, Fuller, Lord & Co. and chief engineer for the New York Ice Machine Co., from 1877 to 1890. Since 1890 he had been connected with the

Titanium company. He invented the process for the manufacture of titanium alloys and pigment and also had many patents here and abroad on metallurgy, electrometallurgy, ice and refrigeration machinery, and iron and steel alloys. Dr. Rossi was the author of numerous technical papers and was the recipient of the Perkins medal for distinguished services in chemistry. He was a charter member of the American Institute of Mining and Metallurgical Engineers, a member of the American Society of Industrial Chemistry and the Chemie Industriale.

Shows Development in Transportation

One hundred years development in rail transportation is the subject of a booklet published recently by the Ingersoll-Rand Co., New York. Horseback was the means of traveling before 1825 when George Stephenson invented his steam locomotive that made a historic run over an iron tramway between Stockton and Darlington in England. The first American built locomotive ordered for actual service was the *Best Friend*, placed on the tracks of the South Carolina railroad in 1830. Times have changed since Stephenson's locomotive sent scared English villagers scurrying to the hillside to escape the *steam devil*. Giant steam locomotives have been built to carry freight across the continent and climb the Great Divide. Demand for smokeless motive power and efficiency in tractive effort has led to the development of electric locomotives.

Won All Three Prizes

An excellent example of the efficacy of the foundry apprentice system employed at the Erie, Pa., plant of the General Electric Co., was shown by its apprentices winning the

APPRENTICES FROM GENERAL ELECTRIC CO. WON PRIZE CONTEST

first, second and third prizes awarded in the contest for foundry apprentices conducted by the American Foundrymen's association at the Detroit convention held Sept. 27-Oct. 1 and reported in the Oct. 15 issue of THE FOUNDRY. The accompanying illustration shows James R. Loveland, winner of the first prize; F. Cordel Gillette and Elmer De Wolf, winners of the send and third prizes.

Patterns used in making castings were exact duplicates. Character of sand, method of gating and other details were left to the judgment of the apprentice. The decision of the judges was based on the appearance of the casting, quality of workmanship and the time consumed in making the casting. Only minor imperfections differentiated the second and third castings from the one receiving the first prize.

Judges of the contest were Benjamin D. Fuller, Whitehead Bros. Co., Cleveland, chairman, Eugene Smith, Crane Co., Chicago, and Pat Dwyer, engineering editor, THE FOUNDRY.

Entrants for the Detroit contest were selected in a local competition which was held between the appentices at the Erie plant. Nineteen castings were submitted in this contest and the best three were sent to Detroit.

To Test Metals

Robert J. Anderson, Inc., 2416 Beekman street, Cincinnati, has been formed to operate a commercial testing laboratory specializing in metals and alloys. Robert J. Anderson is president, H. J. Hater treasurer and R. T. Mesker secretary. These with John Eckerle and E. F. Eckerle make up the incorporators and directors of the new company.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Insitute of Technology, 3200 Federal street Chicago; secretary, ROGERS A. FISKE, 105 LaSalle street, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, J. W. Paxson Co., Luzerne and D streets, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co., N. E. Pittsburgh; secretary-treasurer, WM. J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

Former Staff Member of The Foundry Dies

George A. Drysdale, formerly metallurgical editor of THE FOUNDRY, and recently metallurgical engineer with the Pittsburgh Plate Glass Co., Barberton, O., died at the Lakewood hospital, Lakewood, O., Monday, Nov. 1, after a short illness.

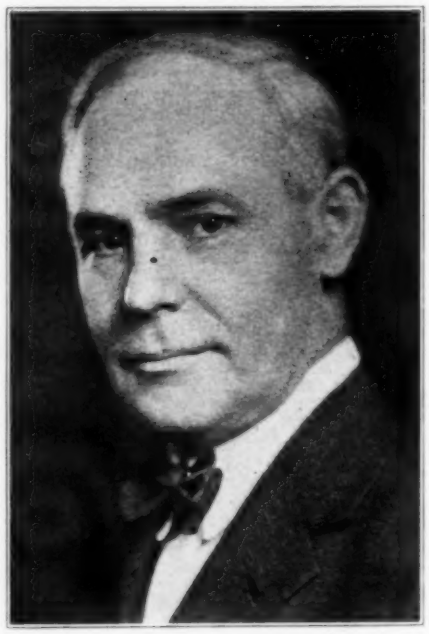
Mr. Drysdale was born in Swansea, S. Wales, England, in 1873, and emigrated to Boston with his parents in 1883. He received his early education in the public schools of Chelsea, Mass., and later attended the collegiate school and university of Kings college, Nova Scotia. He entered McGill university, Montreal, Canada, with advanced standing and was graduated from that institution with a degree of bachelor of applied science in 1898. Later the same university conferred the degree of master of science in recognition of his attainments in practical chemistry and metallurgy.

Mr. Drysdale has been identified with the foundry industry since completing his college work, having been chemist, metallurgist and research director for several firms. His first employment was with the Howard & Bullough American Machine Co., Pawtucket, R. I., where he was foundry chemist in addition to serving his practical apprenticeship in the different departments of the foundry. He left the New England company in 1903 to become metallurgist for the Stover Mfg. Co., now the Stover Mfg. & Engine Co., Freeport, Ill.

In 1907, Mr. Drysdale was engaged to demonstrate foundry coke for Baird & West, selling agents for the Solvay Process Co., Detroit. Later he accepted a position as head of the raw material inspection department of the International Harvester Co., of Canada, Ltd., Hamilton, Ont., and also was given supervision of the chemical and physical laboratories. He remained in Canada until 1911, when he became chemist and metallurgist for the Atlas Engine Works, Indianapolis.

Mr. Drysdale left the Atlas Engine Co., in 1912, to engage in research work for the Ingersoll-Rand Co., Phillipsburg, N. J. He returned to the Atlas Engine Co., reorganized as the Lyons-Atlas Co., and later as the Midwest Engine Corp., Indianapolis, in 1913, and was continuously employed by that company and its associate, the Hill Pump Works, Anderson, Ind., for eleven years.

On Feb. 1, 1924, he took up his work as metallurgical editor of THE FOUNDRY, resigning in June, 1925, to become connected with the Metal Improvement Co., Cleveland. Early in 1926 he became associated with the



GEORGE A. DRYSDALE

Pittsburgh Plate Glass Co., Columbia chemical division, Barberton, O.

He is survived by his widow, one daughter and one son.

Obituary

Frank C. Hamilton, general manager, Federal Steel Casting Co., Chester, Pa., died on Oct. 15 following an operation for appendicitis. He was a graduate of Pennington Seminary, New Jersey. Mr. Hamilton was 41 years old.

Charles A. Ackerson, formerly of the Rochester Car Wheel works, Rochester, N. Y., died in Denver, Oct. 12. After leaving the Rochester works he established the Syracuse Aluminum & Bronze Co. at Syracuse, which later was merged with the American Aluminum & Bronze Corp. at Detroit, Mr. Ackerson becoming treasurer of the latter organization.

Edward Leitelt, member of Leitelt Bros., Chicago, brass and aluminum founders, died Oct. 16. He was born July 4, 1874 at Grand Rapids, Mich., and with his brother organized the company bearing his name.

Charles Elliott, general superintendent of the Mt. Vernon Car Mfg. Co., died at his home in Mt. Vernon, Ill., Oct. 26. He was born in Scotland 58 years ago. He had experience in the shipyards in Scotland and came to this country when about 20 years old. He was in the employ of steel mills in the Pittsburgh district and about 20 years ago entered the car building business. He went to Mt. Vernon in April, 1916, as general superintendent of the Mt. Vernon Car Mfg. Co.

T. E. Cunningham, foundry superintendent, Crompton & Knowles Loom Works, Worcester, Mass., died recently at his home in Worcester.

James B. Stanwood, vice president of the Stanwood Corp., Covington, Ky., died at his home in Cincinnati, Oct. 22, at the age of 70 years. Mr. Stanwood was the author of a number of technical books and was a widely known consulting mechanical engineer.

Charles O'Day, president of the Oil City Boiler Works, Oil City, Pa., died in New York City, Oct. 19, at the age of 56 years. He was born in Rouseville, Pa. a, son of Daniel O'Day, then vice president of the Standard Oil Co.

Jesse A. Vail, former chairman of the board of directors of the Maxwell Motor Co., Detroit, died at Evanston, Ill., on Oct. 23. Mr. Vail formerly was an official in Fairbanks, Morse & Co., Milwaukee, before becoming affiliated with the Maxwell company. He was 70 years old.

George E. Sharpe, identified with the industrial and business life of Steubenvile, O., for 60 years, died in that city, Monday, aged 80 years. Of late years he had directed the Ohio Foundry & Mfg. Co., with a gray iron foundry at Steubenville. This business was founded by Mr. Sharpe's father in 1846 under the firm name of Craig & Sharpe, but when Mr. Craig retired, Sharpe's son stepped in. Some years ago, Mr. Sharpe was interested with others in a wrought iron rolling mill at Steubenville, known as the Alikanna mill.

Sales Engineer Dies

Frank A. Hall, sales engineer, Dempsey furnace division, W. N. Best Corp., New York, was killed in an automobile accident on Oct. 19. He was 35 years old and well known in the industrial furnace industry. Mr. Hall was graduated from the University of Pennsylvania and was connected at various times with the Bristol Co., F. J. Ryan & Co., and the Republic Flow Meter Co.

J. E. M. Schultz has been appointed manager of the Dallas, Tex., office of the Sullivan Machinery Co. He has been associated with the Knoxville, Tenn., office in charge of business in the southeastern states.

Coupling Device Used on Industrial Tractor

A trailer for industrial haulage which is equipped with two caster wheels has been introduced by the Clark Tructractor Co., Buchanan, Mich. The platform is 3 feet wide and 6 feet long and the top of the platform is 13½ inches from the ground. The platform is made of hardwood 1⅛ inches thick running crosswise of the trailer and held in place by beveled sills running on each side of the top platform. The platform frame is one piece of T-shaped iron encircling the platform. Two angle iron griders run lengthwise underneath the platform to give additional support and to form a support for the front caster wheels.

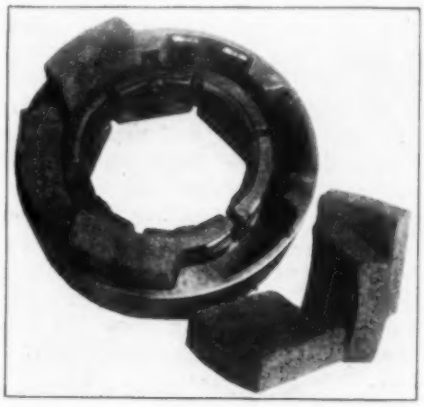
Two steel pockets are provided on each of the four sides of the platform to hold the rails in place, which in turn hold the freight in place on the platform. The platform rack is of 1-inch pipe with all joints welded. The racks are 35 inches high above the platform and are interchangeable for either ends or sides. The rear axle is supported on heavy steel brackets securely riveted to the iron frame and reinforced by two additional iron supports. The rear wheel axle is 1¼ inches in diameter and the front wheel spindles are 1 inch in diameter. The front wheels are 10 inches in diameter and 3 inches wide and are equipped with large heavy duty thrust bearings. Both the front and rear wheels are equipped with rollers bearings. All points requiring lubrication are equipped with high pressure lubricating nipples. The wheel-base is 38 inches and the gage 23 inches.

THE UNITS MAY BE COUPLED EASILY

The trailers are equipped with a special automatic coupler, which is shown in the accompanying illustration. It is claimed that this coupling permits trailer trains to turn sharp corners and that the operator may couple or uncouple the trailer without dismounting from the tractor.

Segmental Wheel Chuck Has New Features

A segmental grinding wheel chuck for use on surface grinding machines has been designed by the Pratt & Whitney Co., Hartford, Conn., and is being marketed by the Carborundum Co., Niagara Falls, N. Y. The new chuck, which is a heavy duty unit designed for production work, provides for the mechanical holding of segments by a series of clamping bolts and rocker bearing blocks within a ring or chuck body. The body is specially designed to provide strength and rigidity.



THREE SEGMENTS REMOVED TO SHOW THE POCKETS IN WHICH THEY ARE HELD BY THE ROCKER ARMS

One of the features of the new chuck is the method of holding the segments. A perfect contact is provided in the design of the rocker blocks in the chuck body and on the faces of the outer clamps. Each segment is held in position by independent clamps at both ends. As the curvatures of the outside and the inside of the segments are concentric, any crushing tendency of the ends and the consequent endwise movement of the segments while under strain do not tend to loosen the hold of the clamps. The design is said to avoid the danger of cracking or chipping the segments. When new, the segments rest directly on the bottom of the chuck and, when worn and reset in the second position, they rest on the top of the inner clamps which are pulled forward by bolts provided for the purpose.

ASSEMBLY VIEW OF THE CHUCK SHOWING CLEARANCE BETWEEN ABRASIVE BLOCKS AND CLAMPING MECHANISM

The chuck embodies special features in the provision for a water supply. By tilting the segments outward from the axis an increased supply of water is possible directly at the point of contact between the segmental wheels and the work, as well as between the segments. The tilting of the segments also prevents the water from climbing over the wheel guard.

Another feature of the chuck is the adapters which permit the use of worn segments. When the segments are new they project 2¼ inches beyond the face of the chuck. When reset in the second position they project 2 inches. Adapters are provided for still another position, making it possible to wear the segments to ¾-inch.

Appoint New Salesmen

Clinton Millar, formerly manager of the Montpelier and Barre Power and Light Co., Barre, Vt., will cover the southern territory for the Harrison Supply Co. Inc., Boston. George E. Davidson will have charge of the middlewestern territory and H. J. Gosselin will cover New Jersey.

Purchases Foundry

Ryan-Bohn Foundry Co., Lansing, Mich., has been purchased by Chas. E. Bohn, trustee, at a foreclosure sale. The seller was the Iron Castings Co. The sale price was $328,000 and was to satisfy three series of bonds outstanding.

Evan J. Parker, formerly with the Morgan Engineering Works, Alliance, O., now is connected with the Northern Engineering Works, Detroit. He will have charge of the sales promotion division.

Finds Relative Moisture in Molding Sand

The R. W. McIlvaine Co., 53 West Jackson boulevard, Chicago, recently has placed a device on the market for determining the relative moisture in molding sand. The device operates

RELATIVE MOISTURE CONTENT IS REGISTERED ON THE METER

on the principle of the varying conductivity of moist sand. The greater the moisture in the sand, the higher the reading will be in the meter in the head of the instrument.

The current is supplied by eight flashlight batteries located inside of the nickeled brass tube that forms the main shaft of the instrument. The batteries will last a long time, it is claimed, since the amount of current used is small. The lower end of the tube is fitted with a plunger that rises in the tube as the instrument is thrust into the sand, thus picking up a sample of the sand. This sample is held under a uniform pressure by spring tension on the plunger, thus keeping the density the same for every test. When the springs are compressed to a certain point, an electrical contact is made which gives an instantaneous reading on the meter. Increasing or decreasing the pressure slightly makes no variation on the meter reading. The current from the batteries passes from one terminal to the other, located in the end of the rod, through the test pieces held under pressure. When the instrument is pulled from the sand, the spring plunger expels the specimen and returns to the normal position.

A standard resistance is supplied which fits inside the tube in place of the sample of sand. The value of this resistance is permanent. The resistance is used to detect voltage drop which may be due to worn out batteries, and to calibrate the instrument to standard.

The device is adjusted by a key which fits in the under side of the head and varies another resistance that is wired in the circuit. The immediate effect of turning the key is to change the reading on the scale of the indicating meter, thus enabling the operator to set the meter to a standard reading.

The plunger is fitted with a rod that extends the entire length of the shaft and terminates in a button on the head of the instrument. This rod moves with the plunger and the plunger's movement may be controlled by the rod. This is used when readings are desired deep in the sand. In such cases the thumb of the operator is held on the button end of the rod while thrusting the shaft into the heap. Upon reaching the desired depth, the thumb is removed and further pushing will result in a reading of the sand at that point. The rounded end of the plunger plows through the sand and does not carry the top layer with it. The device is designed for shop use and is not a delicate laboratory instrument, it is claimed.

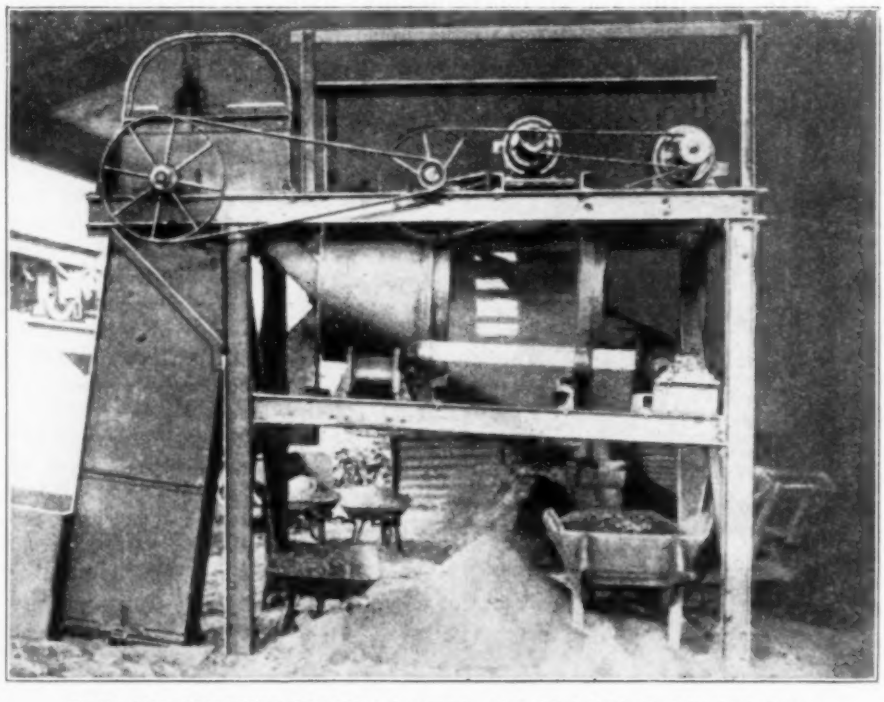
Reclaims Foundry Sand

Equipment for preparing foundry sand, which includes a special screen type separator, has been introduced by the Rapid Magnetting Machine Co., Ltd., Birmingham, England. Barrow loads of sand are tipped into the hopper of the elevator, which is shown at the left of the accompanying illustration. This hopper is fitted with a grid to prevent bricks and large pieces of iron from entering the machine. The sand is elevated by the bucket elevator and is discharged into a chute. The chute carries the sand into the extension cylinder of the revolving screen. The stationary separator, which is half-moon shaped, produces a strong magnetic field which impinges into the cylinder and magnetizes by induction the feelers fixed to bars placed parallel to the axis and fitted to the inside face.

These feelers comb through the sand and attract the pieces of iron when in the magnetic field. The iron finally is carried to the top position and is discharged automatically. The sand, free from iron, is carried into the fine sieve where the sand is recovered. The oversize and foreign material is discharged separately. Wheel barrows are placed under their respective chutes for the reception of the three separated materials.

Firm Is Reorganized

The G. H. Williams Co., Erie, Pa., builders of buckets for excavating and rehandling machinery has effected a reorganization. W. W. Cochrane now is general manager; J. D. Harter is sales manager; C. D. Buoy, chief engineer, and H. H. Neeve is superintendent.



IRON AND OVERSIZE FOREIGN MATTER ARE REMOVED FROM THE SAND

Equipment Inquiry Heavier

Sales Also Increase in Several Leading Markets—Few New Construction Projects Are Reported Under Consideration—Sellers Rather Optimistic

GRADUAL improvement in the tone of the foundry equipment market throughout the country has been noted during the past few weeks. In some distributing centers the volume of sales has shown an increase and inquiries are heavier.

Sales of equipment in the Chicago territory are in moderate volume. October sales, in many instances, were practically on a par with the preceding month. Some lines of equipment, including sand preparing and handling devices, show substantial activity but no improvement over the last of October.

In the Cleveland market sales of equipment during the last two weeks in October and the first part of November were not up to the level anticipated earlier in the fall. However, an exceptionally large influx of live inquiries is reported. It appears that buyers in that territory are waiting until they are ready to go ahead with a buying program before making inquiries, and it is practically certain in most cases that the equipment will be purchased after prices and other information are requested.

November started out well in keeping with the records of late October in foundry equipment selling in the Pittsburgh area. Orders have been more numerous and inquiries more prolific. A new brass foundry at Johnstown, Pa., is in the market for complete equipment, including furnaces. The Columbiana Foundry Co., McKeesport, Pa., is said to be contemplating the purchase of some additional small equipment, and other foundries nearby want cupolas, core ovens, ladles, molding machines, etc.

The eastern market is featured by an improvement in inquiry. Sellers report that specifications are more numerous than in two or three months. These inquiries have not increased business closed, since a number merely seek figures to estimate appropriations for next year. Virtually all orders are for replacements and involve single items of equipment. Little new construction is noted.

Sales of foundry equipment have about held their own in New England during the last two weeks. Many foundry alterations and additions are under way in the district, and these offer a potential demand for equipment. However, in most cases sales are slow to develop. Most dealers feel that equipment sales will improve before the end of the year.

PITTSBURGH MARKET

Dust Arrester Equipment

Ellwood Foundry & Machine Co., Ellwood City, Pa.; Maxwells, Ltd., St. Marys, Ont.; from the J. S. McCormick Co., Pittsburgh.

Furnaces

Columbiana Foundry Co., McKeesport, Pa., one cupola; Richmond Radiator Co., Uniontown, Pa., one cupola; Union Radiator Co., Johnstown, Pa., one cupola; Southern Railway Co., Baltimore, one cupola; Clark Bros. Co., Olean, N. Y., one cupola; from the Whiting Corp., Harvey, Ill.

Ladles

Baltimore & Ohio railroad, Baltimore, helical worm geared ladles from the Whiting Corp., Harvey, Ill.

Molding Machines

Pittsburgh Plate Glass Co., Ford City, Pa., tractor type sand throwing machine; Sanitary Mfg. Co., Allegheny, Pa., stationary type sand throwing machine; Clark Bros. Co., Olean, N. Y., motive type sand throwing machine from the Beardsley & Piper Co., Chicago.

CHICAGO MARKET

Furnaces

Koken Co., St. Louis, one cupola; Holland Furnace Co., Holland, Mich., one cupola; from the Whiting Corp., Harvey, Ill.

Ladles

National Malleable & Steel Castings Co., Chicago, two 12-ton ladles; from the Whiting Corp., Harvey, Ill.

Molding Machines

Hire Foundry Co., Peoria, Ill., portable sand throwing machine; Menzel & Jeffery Co., Minneapolis, portable type sand throwing machine; Robert Holmes & Bros., Danville, Ill., wheeled portable type sand throwing machine, Studebaker Corp., South Bend, Ind., two stationary type sand throwing machines from the Beardsley & Piper Co., Chicago.

Sand Preparing Equipment

Medart Co., St. Louis; Homestake Mining Co., Lead, S. D.; Joseph F. Rothe Foundry Co., Green Bay, Wis.; Griffin Wheel Co., Chicago; Texas Steel Co., Fort Worth, Tex.; Arneson Foundry Co., Kenosha, Wis., sand mixers from the National Engineering Co., Chicago.

Shakeout Equipment

Holland Furnace Co., Holland, Mich.; Griffin Wheel Co., Council Bluffs, Iowa; American Seating Co., Grand Rapids, Mich.; vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Tumbling Barrels

Holland Furnace Co., Holland, Mich., one; American Steel Foundries Co., Chicago, one; from the Whiting Corp., Harvey, Ill.

NEW ENGLAND MARKET

Ladles

Plainville Castings Co., Plainville, Conn., pouring device from Whitehead Bros. Co., Providence, R. I.

Molding Machines

Rhode Island Malleable Iron Works, Hillsgrove, R. I., two; Barbour Stockwell Co., Cambridge, Mass., two; from the Tabor Mfg. Co., Philadelphia.

CLEVELAND MARKET

Furnaces

Browning Crane Co., Cleveland, one cupola, from the Whiting Corp., Harvey, Ill.

Ladles

Detroit Gray Iron Foundry Co., Detroit, one 5-ton helical worm geared ladle from the Whiting Corp., Harvey, Ill.

Molding Machines

Advance Foundry Co., Dayton, O., portable type sand throwing machine from the Beardsley & Piper Co., Chicago.

Ferro Machine & Foundry Co., Cleveland, 24 vibrator core machines and 8 plain strip core machines from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Shakeout Equipment

Ferro Machine & Foundry Co., Cleveland; U. S. Radiator Co., Detroit; Elmwood Castings Co., Cincinnati; vibrators and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

NEW YORK MARKET

Molding Machines

Fairmount Foundry Co., Philadelphia, portable type sand throwing machine; Abram Cox Stove Co., Philadelphia, tractor type sand throwing machine; from the Beardsley & Piper Co., Chicago.

Sandblast Equipment

Ferrun Casting Co., Littletown, N. Y., from the J. W. Paxson Co., Philadelphia.

Sand Preparing Equipment

Otis Elevator Co., Yonkers, N. Y., sand mixer from the National Engineering Co., Chicago.

New Trade Publications

GRINDING—Abrasive Co., Philadelphia, has issued a folder describing the uses for its new grinding wheels bonded with bakelite.

BUCKETS—Features of its new drag line bucket are presented in a folder issued by the Hayward Co., New York.

TRAMRAILS—Another one of a series of pamphlets showing installations of its tramrail systems recently has been published by the Cleveland Crane & Engineering Co., Wickliffe, O.

CHAIN SLINGS—Stressing the importance of proper slings and hooks for use with chain hoists, Herbert Morris Inc., Buffalo,

has issued a leaflet describing its adjustable slings for various uses, each adapted to the particular problem presented in lifting various classes of burden with safety and efficiently.

MOTORIZED POWER—General Electric Co., Schenectady, N. Y., has issued a bulletin showing applications of motor power to handling of materials, from electric locomotives of various sizes to cranes, tiering machines, loaders and unloaders. Illustrations from actual installations are shown.

WELDING ROD—Koro Electric Corp., Chicago, has issued a folder describing its welding rod, illustrated to show its method of application. This rod is slightly corrugated, the effect being claimed to give a more even stream of molten metal in the flame of the torch.

ELECTRIC MOTORS—Ball and sleeve bearing motors manufactured by the Ohio Electric & Controller Co., Cleveland, are described in a bulletin just issued by that company. Details of construction tending to efficient operation are illustrated.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Shriver Foundry Co., Maryville, Tenn., will rebuild its burned foundry plant 80 x 150 feet.

Magnus Metal Co., Denver, recently dedicated its new brass foundry at 2945 Blake street.

Superior Casting Co., foot of Perry street, Dayton, O. has let contract to Ostendorf-Harris Co. for a 1-story plant 41 x 240 feet.

Chapman Valve Co., Pine street, Springfield, Mass., is building a 1-story machine shop 100 x 450 feet at Indian Orchard, Mass.

Standard Calorimeter Co., East Moline, Ill. has let contract to Axel Carlson Construction Co., Moline, for a foundry plant 60 x 120 feet.

Perfection Grate & Supply Co., 164 Birnie avenue, Springfield, Mass. will build a 1-story addition to its foundry.

Cumberland Foundry Co. Inc., Cumberland, Md. has been incorporated with $50,000 capital by Roy C. Lentz and Augustus Markham.

J. Janitschek, 59 Lake street, Jersey City, N. J. is building a 1-story foundry addition 50 x 75 feet.

Gorrell Carnes Foundry Co., Lima, O. has been incorporated with $25,000 capital to operate a foundry by J. A. Gorrell, K. W. Carnes and R. P. MacKenzie.

Metrie Metal Works, Erie, Pa., Bank H. Payne manager, Nineteenth street and Payne avenue, is considering plans for a foundry building.

Joubert & Goslin Machine & Foundry Co., 800 North Thirty-fifth street, Birmingham, Ala., will build an addition to house production of drying and evaporating equipment.

Strack Foundry, Poughkeepsie, N. Y. has been incorporated with $15,000 capital by W. Strack, F. Strack, and Z. Strack. A. C. Dow, Poughkeepsie, N. Y., is attorney.

Columbia Foundry Co., McKeesport, Pa., manufacturer of stoves and ranges, has let contract to P. L. Fleckenstein for a 1-story foundry addition 20 x 120 and 80 by 80 feet.

Wilmington Pattern & Mfg. Co., Newport, Del. has completed its plant 50 x 70 feet for the manufacture of patterns. Samuel H. Caufman is president and general manager.

Peninsular Stove Co., Detroit has bought 18½ acres at Burt road and Pere Marquette railroad as a site for its new plant to provide a 50 per cent increase in capacity.

Ternstedt Mfg. Co., 6307 West Fort street, Detroit, manufacturer of automobile hardware, will build a 3-story addition for which equipment will be required.

Economy Bronze & Aluminum Co., Cleveland has been incorporated with $20,000 capital by William McWeeney, E. B. Zwick, James Hrabak, Ida Zwick and Samuel Barkan.

Perfect Circle Co., Newcastle, Ind., Lathan Teeters manager, Hagerstown, Ind., is considering plans for a foundry plant to be built in 1927.

State Foundry Works of Virginia, Norfolk, Va. has been incorporated with $20,000 capital by R. E. Wood, 1612 A. street, to manufacture grate bars for marine use.

Delaware Brass & Aluminum Co., Muncie, Ind., manufacturer of brass and aluminum products, is building an addition to its plant to increase output.

Otis Elevator Co., Quincy, Ill., George Gardner manager, has let general contract to Buerkin & Buerkin for a 2-story pattern shop 60 x 75 feet.

Plymouth Castings Co., Plymouth, Ind. has been incorporated with $10,000 capital to manufacture malleable castings by Joseph B. Lewis, John E. Fogarty and Emma Lewis.

Neptune Meter Co., 50 East Forty-second street, New York, has let contract to C. Curtis Woodruff Co., 213 Tenth avenue, Long Island City, for a 3-story plant 40 x 40 feet and 50 x 125 feet at Long Island City.

Union Radiator Co., Johnstown, Pa., C. C. Good general manager, has let contract to Wilson Construction Co., Johnstown Trust building, for a 1-story foundry building, 83 x 124 feet.

Keokuk Steel Casting Co., Keokuk, Iowa, J. C. Bode manager, Commercial and M streets, has let contract to Michelmann Steel Construction Co., Quincy, Ill., for a 1-story factory addition 36 x 277 feet.

Medart Mfg. Co., St. Louis, Edward J. Medart president, 3535 DeKalb street, has let contract to J. H. Wise Construction Co., 911 Syndicate Trust building, for a foundry building and core room 1-story 50 x 300 feet.

Forest City Foundry Co., Cleveland, A. Gerdum president, 1220 Main street, has let contract to H. G. Slatmeyer & Son, 203 Lakeside avenue, for a 1-story foundry 60 x 150 feet.

American Steel Foundries, East St. Louis, R. P. Lamont president, 400 North Michigan boulevard, Chicago, has let contract to Sumner Sollitt Co., 307 North Michigan boulevard for repairs, remodeling and extensions of its plant here.

Rankin Foundry Co. Inc., Newark, N. J. has been incorporated with 1000 shares no par value by Courtland Palmer, East Orange; Harold D. Latham, Pequannoc; Antojnette Sachs, Brooklyn, N. Y. Hayes & Palmer, New York, are attorneys.

Twin City Brass & Aluminum Foundry Co., 815 Washington avenue, S.E., Minneapolis, has been incorporated with $50,000 capital to operate a foundry by I. N. Anderson president, Theodore Johnson vice president, and E. A. Anderson secretary and treasurer.

Active Stove Mfg. Co., Sinking Spring, Pa. has been incorporated with $5000 capital to manufacture stoves, ranges and heating devices by Ephraim Witman, and Harry Stott, Sinking Spring, and J. M. Hertlein, 133 South Ninth street, Reading, Pa.

Landon Radiator Co., Tonawanda, N. Y., Archer A. Landon president, 1104 Marine Trust building, Buffalo, N. Y., has let contract to Crooker & Carpenter, Crosby building, Buffalo, for a 1-story addition 24 x 50 feet and alterations to its plant.

Chain Belt Co., Milwaukee, has let general contract to Dahlman Construction Co. for an added unit to its Orchard street works, 120 x 308 feet. Steel has been awarded to Milwaukee Structural Steel Co., Frank D. Chase Inc., Chicago, is engineer.

Automatic Furnace Co., Dayton, O., manufacturer of furnaces, stokers and coal feeders, has been reorganized with W. J. Rosencrans president and treasurer, J. A. Leiter vice president and secretary, and H. M. Swindler chief engineer.

Wanner Malleable Castings Co., Hammond, Ind., has closed its plant at Beloit, Wis., and has concentrated production of castings at its Hammond works. Additions are being built and the annealing capacity is being enlarged. The buildings at Beloit will be sold.

Eastern Brass Foundry Inc., Cambridge, Mass. has been incorporated with 100 shares no par value to operate a foundry to make brass, bronze and aluminum castings by William T. Royce president, 23 Boardman street, Cambridge; John B. Welch, 18 Prentiss street, Cambridge, and M. J. Nolan.

Birmingham Machine & Foundry Co., Birmingham, Ala., George M. Morrow, president, has added to its line of products an automobile lifter for garage and repair shop use. Its other products are cotton presses, gasoline pumps, sugar refining machinery, soil pipe and fittings and general castings.

The Massachusetts state prison at Charlestown will enter the foundry industry, according to a recent report of E. C. R. Bageley. Construction of the new foundry will be started at once and it is expected that production of manhole covers and school desk castings will start early next year.

South Foundry & Machine Co., Los Angeles, has taken over the foundry plant of the Craig shipbuilding plant at Long Beach Harbor, equipped with two cupolas with daily capacity of 25 tons. The plant is about 100 x 100 feet and will be devoted to the production of dredge and marine work, oil well machinery, pumps, diesel and gas engines.

San Angelo Foundry & Machine Co., San Angelo, Tex., A. A. Koch president and general manager, has been organized and has taken over the plant and business of the San Angelo Foundry & Machine Co. Manufacture of power hammers, shears, pump jacks, vise posts and other devices will be continued.

McConway & Torley Co., Pittsburgh, has sold its plant on the Allegheny river bank between Fifty-fifth and Fifty-sixth streets, Tenth ward, to the Atlantic Refining Co., the adjoining property holder. There are about 5.6 acres with buildings involved. The main plant of the McConway & Torley company is at Forty-eighth street and the Allegheny Valley railroad.